









MATERIA MEDICA FOR NURSES





A TEXTBOOK OF  
MATERIA MEDICA  
FOR NURSES

BY

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ILLUSTRATED



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TO MY WIFE, WHO WAS FORMERLY A NURSE,  
AND TO MISS MARY McMAHON, SUPERIN-  
TENDENT OF NURSES IN THE TRAINING  
SCHOOL OF ST. JOSEPH'S HOSPITAL, OMAHA,  
THIS BOOK IS SINCERELY DEDICATED.



## PREFACE

The schedules of studies in the training schools for nurses in this country allow an average of about twenty-four hours for Materia Medica during the entire course. When a textbook of from four hundred to seven hundred pages is placed in the hands of the average nurse in training with such a limited time at her disposal in which to gain a working knowledge of its contents, the result can easily be imagined.

This little book is written for the undergraduate nurse in training and with her needs and limitations constantly in mind. Its aim is to provide her with a book of twenty-four short chapters in which she can obtain easily and in language she can readily understand, the information concerning drugs and remedies which she needs in her calling.

The graduate nurse or student needing a larger reference work, will find some excellent ones on the market. This book is written for those with a limited time at their disposal.

A. L. MUIRHEAD.

Omaha, Nebraska.



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# MATERIA MEDICA FOR NURSES

## CHAPTER I

### INTRODUCTION

**Materia Medica** is a science which considers medicinal substances from every standpoint. Its meaning is often limited to a study of the source, composition, preparations and doses of remedies but in this book it is used in its broadest sense, including pharmacology, therapeutics, and toxicology.

**Pharmacology** is the study of the action of drugs on living things.

**Therapeutics** is the study of the beneficial effects of remedies.

**Toxicology** (the science of poisons) is the study of the harmful effects of drugs.

A **drug** is any crude medicinal substance, but the name is generally applied to anything used as a remedy.

A **remedy** is any medicinal substance that prevents, relieves, or cures disease.

### Action of Drugs

All useful remedies have some action on living things, either local, general or both of these.

**Local action** is the effect at the place to which a remedy is applied. It may be soothing, irritating, or destructive (caustic).

**General action** is the effect after the absorption of a remedy into the blood stream. Any or all tissues of the body may be influenced thereby. Drugs do not act in any mysterious manner; they merely increase or decrease the normal activity of an organ or tissue, but can not change its character. If the normal activity of an organ is increased we call it *stimulation*; if it is lessened we call it *depression*; and if it is entirely suppressed we call it *paralysis*.

### Dosage

No fixed amount of any remedy can be used for all persons and under all circumstances. The doses given in this book are such as are considered safe and adequate for an average adult, but, under certain conditions, may have to be greatly increased or diminished. The dose of any remedy must be modified to suit the *age* and *size* of the patient. A man weighing 250 pounds will require approximately twice as much as one weighing only 125 pounds. For determining the dose at any age, *Dr. Young's rule* is a fairly good method. Divide the age of the child by the age plus 12. The resulting fraction of the adult dose will usually be a safe dose for the child. For example, if the adult dose of sodium bromide be 30 grains, the dose for a child 8 years old will be found thus  $\frac{8}{(8+12)} = 2/5$ , and  $2/5$  of 30 grains is 12 grains, the dose for the child.

**Women** may require slightly smaller doses than men of the same size because they often react more strongly to some remedies than men do. During *menstruation*, *pregnancy*, and *lactation* some remedies must be given in less than ordinary doses or not at all, as they have a special effect on these conditions.

**Idiosyncrasy** is a condition in which an unusual effect results from giving a usual amount of some remedy or food. Small amounts of cocaine in some cases cause alarming illness and one strawberry eaten by certain persons makes them quite sick.

**Tolerance** is a condition in which an unusually large dose of some drug can be taken without harm. This condition is usually produced by repeated use of the drug, but a natural tolerance is often seen in certain species of animals.

### Methods of Giving

Drugs intended for local action are applied in some form or other to the parts upon which they are intended to act. Drugs for general action may be given in any one of the following ways, which are arranged in the order of rapidity of results.

- Intravenous Injection.
- Inhalation.
- Hypodermic Injection.
- By Mouth.
- By Rectum.
- By Application to the Skin.

**Intravenous injection** of remedies is made in two ways. One is by passing a hollow needle through the wall of a distended vein, and the other by making a small opening into a vein and inserting and fastening a small cannula.<sup>1</sup> The solution can then be injected through the needle or cannula. The remedy for intravenous use must be free from solid particles, must be absolutely sterile, must not injure the blood and should

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<sup>1</sup>*Cannula*, a small tube for insertion into a blood vessel, trachea, or similar passage.



be about the temperature of the body. This method requires considerable skill and some experience to be safely and successfully carried out. The results are very prompt and smaller doses than are given by other methods are necessary.

**Inhalation** can be used only when gases or volatile liquids are given. Ordinary anesthetics are given in this way and other remedies occasionally. Accurate dosage is more difficult by this than by other methods.

**Hypodermic injection** can be used when the dose of the remedy is small, when it is readily soluble in water, and not very irritating. In this method also the solution must be sterile and free from solid particles which might clog the small needle.

**By mouth** is the method of giving medicines most frequently used. Either solids or liquids are given this way. The results are slower, and larger doses are required than in the preceding methods. All remedies given by mouth pass through the liver before entering the blood stream.

**By rectum** drugs are used more frequently for local effect than for general action. Either fluids or solids in the form of suppositories can be used in this way. A fluid given in this way is called an enema. Quite frequently large amounts of dilute solutions of various salts are given very slowly in this way, and are absorbed into the circulation.

**Application to the skin** is used mostly for local effect, but occasionally, as in the use of mercury ointment, it is used to get the remedy into the blood stream. In this method of application drugs are usually mixed with fats or oils. Absorption is somewhat slow and accurate dosage difficult.

## Preparations

Drugs are not often given in their natural state. Usually the drug, or the soluble part of it, is dissolved in some fluid or mixed with other substances to improve or disguise the taste, or prepared in some way for convenient administration. Whatever the method of preparing the drug may be, the product is called a preparation.

### Watery Preparations

**Medicated waters** contain some volatile remedy in solution. They are usually quite dilute.

**Decoctions** are solutions made by boiling parts of plants in water.

**Infusions** are made by soaking parts of plants in water, hot or cold, but not kept boiling.

**Mixtures** are made by suspending<sup>2</sup> insoluble powders in water by means of gums or other sticky substances.

**Emulsions** are made by suspending oils, or other insoluble liquids, in water by means of gums or other sticky substances.

**Syrups** are strong solutions of sugar in water. They may contain some active remedy or only sugar.

### Alcoholic Preparations

**Spirits** are solutions of volatile drugs in alcohol.

**Tinctures** are solutions mostly of nonvolatile drugs in alcohol.

**Elixirs** are dilute alcoholic solutions usually sweetened and flavored.

**Fluid extracts** are solutions in alcohol, water or a mixture of both, in which the volume corresponds to the weight of the crude drug from which it was made.

---

<sup>2</sup>*Suspending*, to keep floating in the liquid without settling or coming to the top.

**Liniments** are dilute medicated solutions for application to the skin.

Tinctures and fluid extracts are used more frequently than other preparations and all important plant drugs are made up in one or both of these forms.

### Solid Preparations

**Extracts** are solid preparations made by evaporating fluid extracts to a sticky mass or a dry powder.

**Pills** are round or oval masses of small size usually containing a single dose of some remedy.

**Powders** are dry remedies which are in a state of fine subdivision.

**Tablets** are small, round, disc-shaped bodies containing some drug intended to be swallowed or used in making a solution.

**Troches** are similar to but larger than tablets, as a rule, and are intended to be held in the mouth until dissolved.

**Ointments** are solid, oily preparations for rubbing on the skin where they melt.

**Cerates** resemble ointments but are made harder with wax enough to prevent melting at ordinary skin temperature.

**Plasters** are adhesive materials, usually medicated, and spread on cloth. They soften and stick when applied to the skin and warmed.

**Suppositories** are conical or ovoid solids for insertion into some body cavity where they melt.

## CHAPTER II

### WEIGHTS, MEASURES, AND SOLUTIONS

#### Weights and Measures

The commercial system of weights known as *avoir-dupois* is not used in weighing remedies for the sick. A special system is used for that purpose known as *apothecaries' system*. Only solids, used as remedies, are weighed in this country; liquids are usually measured. The smallest weight in use is a grain, which originally meant a grain of wheat. It is commonly written "gr." The smallest liquid measure in use is a minim, a trifle less than the quantity of water that would weigh a grain. It is commonly written "m."

#### TABLE OF SOLID WEIGHTS

|           |   |                                 |
|-----------|---|---------------------------------|
| 60 grains | = | 1 dram, written $\mathfrak{z}$  |
| 8 drams   | = | 1 ounce, written $\mathfrak{z}$ |
| 12 ounces | = | 1 pound, written lb.            |

#### TABLE OF LIQUID MEASURES

|           |   |                                          |
|-----------|---|------------------------------------------|
| 60 minims | = | 1 fluid dram, written fl $\mathfrak{z}$  |
| 8 drams   | = | 1 fluid ounce, written fl $\mathfrak{z}$ |
| 16 ounces | = | 1 pint, written pt. or O.                |
| 2 pints   | = | 1 quart, written qt.                     |
| 4 quarts  | = | 1 gallon, written gal. or C.             |

In many countries the metric system of weights and measures is the only one used. In this country it is coming more and more into use and it is necessary for any person handling drugs to understand it. It is really much simpler than the older systems, as the

weights and measures are uniform and their relations are always multiples of ten.

The unit of weight, a gram, is the exact weight of the unit of volume, a cubic centimeter of water. The gram is commonly written "gm.," and the cubic centimeter "c.c." Quite often the c.c. is written mil. for milliliter. The actual name of the quantity need not be written as the position of the numeral in relation to the decimal point determines its value.

#### TABLE OF METRIC WEIGHTS

- A gram (the unit of weight) is written 1.0 gm.
- A decigram (1/10 of a gram) is written 0.1 gm.
- A centigram (1/100 of a gram) is written 0.01 gm.
- A milligram (1/1000 of a gram) is written 0.001 gm.
- A kilogram (1000 grams) is written 1000.0 gm., k., or kg.

#### TABLE OF METRIC MEASURES

- A cubic centimeter (or milliliter) is written 1.0 c.c. or mil.
- A tenth of a cubic centimeter is written 0.1 c.c. or mil.
- A hundredth of a cubic centimeter is written 0.01 c.c. or mil.
- A liter (1000 cubic centimeters) is written 1000 c.c. or mil.

It is sometimes necessary to change weight or measure from the metric into the apothecary system, or from the apothecary system into the metric.

Some of the equivalents are given below.

#### RELATIVE WEIGHTS

- A milligram (0.001 gm.) is about 1/65 grain.
- A centigram (0.01 gm.) is about 1/6 grain.
- A decigram (0.1 gm.) is about 1½ grains.
- A gram (1.0 gm.) is about 15 grains.
- A kilogram (kg. or k.) is about 32 ounces.

#### RELATIVE MEASURES

- A cubic centimeter (1.0 c.c. or mil.) is about 15 minims.
- A liter, (1000 c.c. or mil.) is about 32 oz., or 1 qt.

In changing from apothecaries' to the metric system, the following values will be a guide.

#### RELATIVE WEIGHTS

A grain is about 65 milligrams, 0.065 gm.

A dram is about 4 grams, 4.0 gm.

An ounce is about 30 grams, 30.0 gm.

#### RELATIVE MEASURES

A minim is about 0.065 c.c. or mil.

A dram is about 4.0 c.c. or mil.

An ounce is about 30.0 c.c. or mil.

A pint is about 500.0 c.c. or mil.

A quart is about 1000.0 c.c., or 1 liter.

Very often, in domestic nursing, a graduate for measuring liquids is not available, and some household article may be used to measure, approximately, the amount required.

Often the dose to be given is stated in drops, and drops are of various sizes. When water solutions are measured with a dropper, the drop is about a minim. Alcoholic solutions, measured in the same way, require about 2 drops to make a minim.

#### HOUSEHOLD EQUIVALENTS

A teaspoonful is about 1 dram, or 4.0 c.c.

A tablespoonful is about  $\frac{1}{2}$  ounce or 16.0 c.c.

A teacupful, or tumblerful is from 6 to 8 ounces, 180-240 c.c.

As a rule, the amount of a solid can not be determined by measuring it, as some remedies are much lighter than others. Morphine, quinine and tannic acid are examples.

### Solutions

Solutions of many kinds are used in medicine, and the amount of drug to be dissolved in making a solution is stated in different ways.

1. The quantity of drug dissolved in 100 parts of solution is known as *per cent*.

2. The quantity of drug in 1000 parts of solution is known as *per thousand* (or M).

3. The number of grains in an ounce of solution is known as *grains per ounce*.

In the apothecaries' system there are 480 minims in an ounce of a fluid, but in calculating the amount of drug to be used in making a solution it is much simpler to assume 500 minims as the equivalent of an ounce, and the result will be correct enough for all practical purposes. It is easy to calculate per cent or per thousand on this basis of 500 minims. Thus, to make 4 oz. of a 2 per cent solution,  $500 \times 4 = 2000$  and 2 per cent of 2000 is 40 minims or grains. Therefore 40 grains in 4 oz. of solution is approximately a 2 per cent solution. To make a pint (16 oz.) of a 1:2000 solution,  $500 \times 16 = 8000$  and  $8000 \div 2000 = 4$  minims or grains. Therefore 4 grains in a pint of solution is approximately a 1:2000 solution.

Perhaps a simpler method is to remember that 1 per cent is 5 grains per ounce (500 minims); 2 per cent is 10 grains; 4 per cent is 20 grains, etc. Now by multiplying the number of grains per ounce in a given percentage by the number of ounces required, the amount in grains needed is obtained. Thus, to make 2 oz. of a 5 per cent solution,  $5 \times 5 = 25$  the number of grains per ounce, and  $25 \times 2 = 50$  grains, the amount required.

When the strength of a solution is stated in grains per ounce, all that is necessary is to multiply this by the number of ounces of solution required.

When exact solutions are necessary the metric system should be used, as there are no exact equivalents between weight and volume in the apothecaries' system.



As relative values in the metric system are expressed in multiples of 10, it is comparatively easy to calculate per cent or per thousand solutions by it. Thus, to make 50 c.c. of a 3 per cent solution—3 per cent of 50  $= 50 \times .03 = 1.5$  c.c. or grams, as a gram is the exact weight of a c.c. of water. To make 4 liters of a 1:2000 solution, 4 liters  $= 4000$  c.c.;  $4000 \div 2000 = 2$  c.c. or grams. Therefore 2 gm. in 4 liters of solution makes a solution of 1:2000.

A *saturated solution* is one that has as much of the drug as it can hold in solution at a given temperature. If a saturated solution is heated it will dissolve more of the drug, and if it is cooled part of that in solution will separate out as a solid, or form crystals.

### Stock Solutions

Stock solutions are fairly strong solutions of drugs, kept on hand to be diluted more or less before being used. It is often necessary to make per cent or per thousand solutions by diluting such stock solutions, and the simplest method of determining how much of a stock solution to use is as follows.

Divide 100 by the percentage strength of the stock solution and multiply the result by the percentage strength of the solution required. This gives the percentage of stock solution to be used in making the dilute solution. To make a quart of 2 per cent solution from a 40 per cent stock solution,  $100 \div 40 = 2.5$ , and  $2.5 \times 2 = 5$ . A quart is 32 oz. and 5 per cent of 32 is 1.6. Therefore 1.6 oz. of the stock solution will make a quart of the required 2 per cent solution.

Calculating the amount of stock solution required when the metric system is used in per thousands is not very difficult. To make 1000 c.c. of a 1 to 4000 so-



lution from a stock solution of 1 to 50,  $4000 \div 50 = 80$ ; that is, the stock solution is 80 times the strength of the solution desired. Now divide by 80 the amount of solution needed, and the result will be the amount of stock solution to be used:  $1000 \text{ c.c.} \div 80 = 12.5 \text{ c.c.}$

In making any solution of a given strength always dissolve the drug in part of the solvent, then add enough more to measure the amount of solution required.

## CHAPTER III

### ANTISEPTICS AND DISINFECTANTS

Very early in the history of mankind it was found that certain gums, balsams and resins had the power of preventing decay in the bodies of the dead, and today the Egyptian mummy is an evidence of the antiseptic efficiency of the materials then used. Some of these substances were also used for healing wounds, but it was not until 1870, when Lister began the systematic use of carbolic acid in his surgical work, that antiseptics came into common use.

Modern surgery is largely based on two principles: **asepsis**, which prevents microbes<sup>3</sup> from getting into a wound or into injured tissue; and **antisepsis**, which retards or prevents their growth after they have gained an entrance. **Disinfection**, which implies the killing or removal of all germs present, is applied more to the material and instruments used in surgery than to the tissue involved, because drugs that destroy germ life also destroy, at the same time, many living tissue cells. Disinfection is also applied to the destruction of microbes generally in their relation to infectious<sup>4</sup> diseases.

The effectiveness of any disinfectant or antiseptic depends not only on the strength of the solution used, but also on the length of time it is in contact with the microbes present. A solution of corrosive sublimate 1:2000 would be more efficient than a solution of 1:3000 in the same length of time, but the weaker solution might become the more efficient if kept in contact with

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<sup>3</sup>*Microbes*, minute living things that can be seen only with a microscope.

<sup>4</sup>*Infectious diseases* are those caused by microbes.

the microbes for a longer time. The longer an anti-septic solution is in contact with a wound the weaker it becomes, because the remedy is taken up, not only by the microbes, but also by the tissue cells. It is impor-

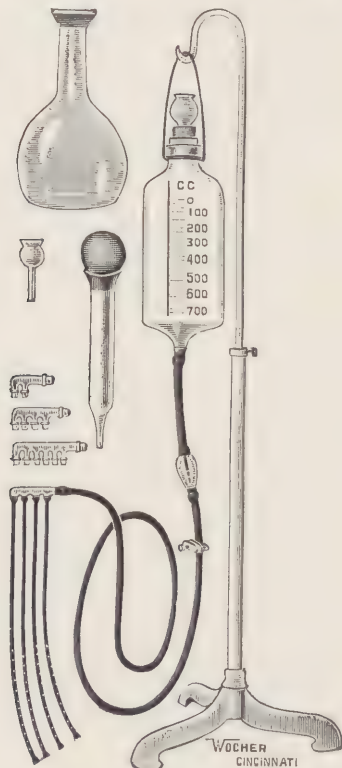


Fig. 1.—Appliance used in the Carrel-Dakin method of treating wounds.

tant, therefore, in infected areas, to supply fresh portions of the antiseptic at frequent intervals or, better still, to maintain a steady supply. This is the basis of the Carrel-Dakin method of treating wounds now in frequent use.

The larger the number of microbes present in a wound the greater the amount of the drug necessary to destroy them or hinder their growth, because each microbe takes in a certain amount of the substance used. In some cases a mixture of several antiseptics is more effective than any one of them alone even in a stronger solution.

As a rule the substances that are more soluble in fats and oils than in water are less actively antiseptic in solution in oil than they are in water. A 5 per cent solution of carbolic acid in an oil is much less antiseptic than the same strength solution in water, because its greater solubility in oil prevents it from readily passing into the bodies of microbes.

Antiseptics are used not only in surgery, but also in many nonsurgical conditions such as infectious diseases.

**Surgical antiseptics**, as a rule, should be soluble in water and not very irritating, especially if used on sensitive surfaces such as the eye, the urethra or bladder. A clean wound requires no antiseptic if it can be kept free from infection. The skin of patient and surgeon can stand stronger solutions than a wound or a sensitive surface can. Instruments and dressing material are usually sterilized by heat. Ligatures are often kept in antiseptic solutions.

**Intestinal antiseptics** are often used. It is not possible to make the intestinal canal sterile, but it is possible to hinder the growth of intestinal microbes and thus lessen the harm they may do. Drugs to be used for this purpose should not be readily soluble in water as they must not be quickly absorbed that they may pass down to the lower bowel where most needed.

They should be nonirritating and not very poisonous to the patient. One of the best methods of intestinal antiseptics is giving a good laxative, such as castor oil or calomel, thus removing a large amount of the harmful material from the intestine.

**The genitourinary tract** quite often becomes infected and antiseptics are used with good results. The remedy can often be applied locally to the vagina, urethra, or bladder, but good results can also be had by giving some readily soluble antiseptic by mouth. The continual washing of the urinary tract by the mildly antiseptic solution formed as the drug is excreted in the urine, is often very effective.

**The lungs and bronchial tubes** are not easily influenced by antiseptics. Volatile remedies inhaled strong enough to harm microbes would, at the same time, damage the delicate lining of the tubes. When given by mouth, traces of volatile remedies escape in the breath but not in sufficient amount to have much effect. It is doubtful whether such remedies are of any benefit in consumption, but they seem to lessen the secretions and fetid odor of the breath in some cases of chronic bronchitis.

**Skin diseases** are often due to infection, and antiseptic remedies are sometimes very useful, but when a large area of skin surface is to be treated there is danger of poisoning from too much of the remedy being absorbed.

**Specific antiseptics** are those remedies that are especially poisonous to the germs of some particular disease and less poisonous to human tissue cells. Quinine in malaria and mercury in syphilis are well-known examples of this.

### Carbolic Acid (Phenol)

Carbolic acid was the first antiseptic used in modern surgery. It is obtained from coal tar<sup>5</sup> and is used extensively in industry as well as in surgery.

**Action and Uses.**—Carbolic acid is poisonous to all forms of life. Even dilute solutions, such as 1 per cent, are quite fatal to some germs, while others can live in such solutions for a long time. Solutions in water even less than 1 per cent hinder the growth of most germs although they may not be killed. Pure carbolic acid is instantly fatal to the life of any microbe with which it comes in contact. It is also caustic and is sometimes used to remove small growths, such as corns, but this is dangerous as it is hard to limit its action. Its caustic action can be promptly checked by washing with alcohol. Even a 5 per cent solution is somewhat caustic and should not be used on living healthy tissue.

In ointments or dilute solutions it is used to relieve itching in many skin diseases. When applied, unless in great dilution, it should not be covered closely with a bandage or clothing as serious gangrene may result.

**Poisoning.**—Carbolic acid poisoning is very common. It has been estimated that 50 per cent of all fatal suicidal poisonings in this country are due to this drug. When taken undiluted, as is usually the case, it burns the lips, tongue, mouth, throat and stomach. The burn is white at first, later becoming red. Pain is felt in the mouth, throat and stomach. Nausea with vomiting often results, but may be absent. Some patients become very much excited and may have convulsions, but more often there is collapse<sup>6</sup> with pallor, cold sweat, feeble, irregular pulse and respiration, and finally unconscious-

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<sup>5</sup>Coal tar, a complex oily liquid obtained from coal in the process of making gas.

<sup>6</sup>Collapse, a failure of the vital forces.

ness before death. When a large amount is taken, death may result in a few minutes from the severe and extensive destruction of tissue.

The odor and the appearance of the burn help to decide what had been used.

In the past, fatal poisonings have resulted from applying solutions of carbolic acid to wounds or using it in douches, but such uses are now pretty generally abandoned.

**Treatment.**—The use of a stomach tube is rather dangerous,<sup>7</sup> but with skill and care it may be passed without doing any damage, and the stomach washed repeatedly with diluted alcohol. If the tube is not used, dilute alcohol should be given in reasonable amounts, as it also is a depressant. A large dose of Epsom salts given through the tube or swallowed will slow absorption of the poison.

Keep the patient warm in bed. A small amount of morphine may be necessary to relieve pain. When collapse threatens, caffeine (coffee) per rectum or strychnine hypodermically should be given. Some give atropine when there is much sweating. Cases that show excitement often get well.

### Cresols (Lysol)

Cresols are obtained from coal tar and are somewhat similar to carbolic acid, but are not soluble in water and are not caustic. To make them soluble in water they are usually put up in a soap or alkaline mixture and sold under some trade name such as Lysol, Creolin and Kreso. An official<sup>8</sup> solution known as Compound

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<sup>7</sup>*Dangerous*, the tube may be pushed through the weakened wall of the esophagus or stomach.

<sup>8</sup>*Official*, recognized by the standard list of drugs of any country, such as the pharmacopoeia.



Solution of Cresols is also available and is practically the same as Lysol.

**Action and Uses.**—The cresols are more actively antiseptic than phenol and are used for many similar purposes, such as disinfecting the hands, the skin, and infected wounds. Rather dilute solutions are used, as the cresols, though not caustic, are quite irritating.

**Poisoning** with cresols is usually the result of some mistake. The effects are similar to those from carbolic acid, except that there are no white eschars (burns). A stomach tube can safely be used and the stomach washed out with dilute vinegar instead of alcohol. In other respects the treatment would be the same as for phenol poisoning.

**Alcohol** is a fairly efficient antiseptic and disinfectant used to clean and sterilize the skin, hands, and instruments. It is too irritating, in strong solutions, for delicate surfaces and too expensive for very general use as an antiseptic.

### **Bichloride of Mercury (Corrosive Sublimate)**

This salt of mercury was used as a surgical antiseptic only a little later than carbolic acid, and its use has been much more general. It requires a little longer time to kill bacteria than carbolic acid does, but it is much more powerful. It is generally used in solution in water varying in strength from 1 in 10,000 to 1 in 1000. The official tablets used in making solutions are angular, not round in shape, are usually colored blue and stamped with skull and crossbones and the word "poison." Each tablet contains about  $7\frac{1}{2}$  grains of the drug and one tablet dissolved in a quart of water makes a solution of approximately 1 in 2000.



Solutions of bichloride of mercury are used extensively to cleanse wounds, the hands and the skin, but are too irritating to be used on delicate mucous membranes. As mercury corrodes steel, such solutions can not be used to disinfect instruments.

**Poisoning** with corrosive sublimate has occurred rather frequently and will be described in another chapter under mercury.

### Silver Nitrate

Salts of other metals besides mercury are sometimes used as antiseptics or disinfectants. Among these the most important is silver nitrate. This is used in infections of the eye and other mucous surfaces, either in solution or as a solid pencil. It is very irritating but superficial in effect, as the chlorides of the tissue make it insoluble. A 2 per cent solution is used in the eye of the newborn to destroy any possible infection from the birth canal. It should be washed off at once with a solution of common salt.

*Argyrol*, *Protargol* and other organic<sup>9</sup> silver compounds are much less irritating than silver nitrate and are efficiently antiseptic. Solutions in water of various strengths are used on mucous surfaces such as the eye, nose, and throat, and especially in the urethra or vagina in gonorrheal infections.

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<sup>9</sup>*Organic* originally meant derived from an organized or living thing, but the term now includes most compounds of carbon.

## CHAPTER IV

### ANTISEPTICS AND DISINFECTANTS

#### Peroxide of Hydrogen

Peroxide of hydrogen is a compound of the same composition as water, but with an excess of oxygen. On coming in contact with living matter, it rapidly gives off oxygen and becomes simply water. It has no effect on germs after the bubbling of oxygen ceases. The nascent<sup>10</sup> oxygen destroys bacteria by oxidizing<sup>11</sup> them. Its use is chiefly in infected wounds with pus, which it cleans mechanically as well as disinfects. It should not be used in a cavity where the gas can not readily escape.

#### Potassium Permanganate

Potassium permanganate is another oxidizing disinfectant. It acts in much the same way as peroxide of hydrogen, but less rapidly, and its effects continue longer. As soon as solutions of permanganate lose their deep purple color, they are almost worthless. Solutions should always be made with distilled water. Such solutions are efficient for surface disinfection, but do not penetrate living tissue. Dilute solutions are used in the treatment of poisoning with morphine, phosphorous, and prussic acid which are oxidized, to some extent, and rendered harmless. Permanganate solutions, or the crystals, are

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<sup>10</sup>*Nascent*, just liberated from a chemical combination,

<sup>11</sup>*Oxidizing*, slowly combining with oxygen,

used locally to destroy the poison in snake bite, but can have no effect on the poison that has been absorbed.

### **Boracic Acid and Borax**

Boracic acid is not very soluble in water, and a 4 per cent solution is about saturated. Neither of these substances are very actively antiseptic but are extensively used because they are nonirritating and not very poisonous. Saturated solutions can be used on almost any surface without injury. Boracic acid solutions are acid, but borax solutions are alkaline.

Boracic acid is sometimes given by mouth in 5-grain doses as a genitourinary antiseptic, and solutions of it are also used to irrigate the bladder when infected. Solutions may be used freely on the eye, nose, or other sensitive membranes without causing irritation.

### **Iodine**

Iodine is an element obtained mostly from sea weed. It is a dark brown, almost black, volatile solid, soluble in alcohol and in a solution of potassium iodide.

The tincture of iodine and Lugol's solution (compound solution of iodine) are used extensively to disinfect the skin, while more dilute solutions may be used for various antiseptic purposes.

Iodine discolors and irritates the skin and may blister if too strong a solution is used, or application made too often. Some iodine is absorbed from the skin and poisoning may result from painting too large an area. Iodine stains can be removed with a solution of sodium thiosulphate.

Iodine is soluble in fats and penetrates the skin deeply in spite of grease or dirt which there may not

be time to remove. It is very efficient in emergency treatment of infected wounds.

Iodine has long been used as a mild but lasting irritant applied over swollen joints and glands.

Should poisoning with iodine occur, boiled starch will act as a fairly good antidote and demulcent.

**Iodoform** was at one time used very extensively as a dusting powder in wounds, but its use has been almost entirely abandoned. It had little antiseptic power, its odor was very unpleasant and it sometimes caused very severe poisoning, when used too freely.

**Aristol** (thymol iodide) has taken the place of iodoform to some extent. It is odorless, less poisonous, and more actively antiseptic.

### **Tar and Ichthyol**

Tar is obtained by the distilling of pine wood. Ichthyol is distilled from fossil rock deposits found mostly in Switzerland.

Both are antiseptic and relieve itching. They are used pure or in ointments in a good many skin conditions.

**A Syrup of Tar** is sometimes given for the relief of coughs.

### **Pieric Acid**

Pieric acid is a yellow crystalline powder, soluble to some extent in water and in alcohol. It is an antiseptic and a local anesthetic, and has been used extensively in the treatment of burns and scalds. A saturated solution in water or pieric acid gauze may be applied to the injured surface if it does not involve too large an area. It stains the skin and clothing yellow, and may irritate the surrounding healthy skin.

### Genitourinary Antiseptics

A number of substances given by mouth are excreted in the urine in sufficient amounts to have an antiseptic influence on the urinary passages. Most important among these are the following:

#### Preparations and Doses.—

Urotropin (hexamethylenamin), dose, 5 gr.

|                   |               |
|-------------------|---------------|
| Oil of sandalwood | } dose, 10 m. |
| Oil of cubebs     |               |
| Oil of copaiba    |               |

Urotropin is very soluble in water and should be given well diluted. The oils are put in capsules or made up in an emulsion.

**Action and Uses.**—Urotropin in acid solutions yields formaldehyde. This change takes place in the urinary passages when the urine is acid. It is by far the most efficient urinary antiseptic in use, but sometimes it irritates the bladder. The oils also are excreted in the urine, and are antiseptic and also diuretic.

### Creosote and Guaiacol

These oily liquids obtained from wood tar have been called *pulmonary antiseptics*, but their value in infections of the lungs is not very great. They have a pungent smoky odor and a hot burning taste.

#### Preparations and Doses.—

Creosote (oil of smoke), dose, 3 minims.

Creosote water, dose, 2 drams.

Guaiacol, dose, 5 minims.

Guaiacol carbonate (duotal), dose, 15 grains.

Creosote and guaiacol are only slightly soluble in water. They can be given in milk, or dissolved in some

alcoholic solution. Unless well diluted they irritate the stomach. The carbonate of guaiacol is a white powder, tasteless, odorless and insoluble in water. It is usually given in capsules or powders.

**Action and Uses.**—Both creosote and guaiacol are as antiseptic as phenol, but do not burn, although they may irritate the tissues. Guaiacol is also antipyretic, especially when applied to the skin. Both of these remedies have been much used in the treatment of consumption. They have been given by mouth and by inhalation in vapor, and, although some improvement often follows their use, an actual cure seldom results, as enough of the drug does not reach the lungs to kill the tubercle bacilli.

### **Hypochlorite Solutions**

Various solutions of hypochlorite of soda, either alone or with some other antiseptic, have been used extensively in surgery, and with satisfactory results. The hypochlorites yield chlorine in contact with living tissue, and their solutions give excellent results in the continuous irrigation of infected wounds. The names of Carrel and Dakin will long be associated with the solutions used as well as with the method of continuous supply of fresh antiseptic in a wound.

### **Chloramine**

Dakin and his associates have also introduced the chloramines as valuable surgical antiseptics. Dichloramine-T seems to be the most generally serviceable of these. It is fairly stable, nonpoisonous, and yields its chlorine slowly in contact with living tissue.

Various other chlorinated preparations have been used as antiseptics. The available chlorine seems to be



the measure of efficiency in all of these chlorine yielding compounds.

### Disinfection

When moist heat can be applied, it is the most effective disinfectant known, but many articles in a sick room can not be disinfected in that way and a number of chemical disinfectants are in use.

**Formaldehyde** is usually obtained from **formalin**, a solution of the gas in water of a strength about 40 per cent. It is also obtained from **paraform**, a solid which yields formaldehyde as it burns. This gas is too irritating for use as a general antiseptic, although it is not very poisonous to man. It can be used, either as a vapor or in solution, to disinfect instruments, furniture, clothing and rooms. To disinfect a room with formaldehyde, it should be as nearly air-tight as possible, and should be shut up for ten hours. The quantity necessary for efficient disinfection has been estimated as the amount of the gas obtainable from 5 oz. of formalin for each 1000 cubic feet of space in the room. Formaldehyde not only destroys germs but also the toxins which they produce.

**Sulphur dioxide** is obtained by burning sulphur. The vapor is very irritating when inhaled. It is soluble in water but used mostly as a vapor. Sulphur dioxide is used to disinfect rooms and furniture. Its bleaching action on colored fabrics makes its use more limited than that of formaldehyde. One volume per cent in air is needed for effective disinfection, and to obtain this about 4 or 5 pounds of sulphur should be burned for every 1000 cubic feet of room space. The room should be closed up air-tight for 20 hours. A moist vapor is much more effective than dry.



**Chlorine** gas is usually obtained for disinfection uses from **chlorinated lime**. This contains calcium hypochlorite which yields its chlorine when moistened.

Chlorine is even more irritating than formaldehyde or sulphur dioxide. Air containing 1 part in 100,000 causes severe irritation of the eyes, nose, and respiratory passages, and 1 part in 3000 may prove fatal in a few minutes, if inhaled, by causing edema<sup>12</sup> of the lungs, and suffocation.

Chlorine has bleaching properties similar to sulphur dioxide and can not be used with colored fabrics. It is useful to disinfect urinals, closets and various receptacles of infectious material. It is also useful as a deodorant in sick rooms.

Chlorine, in the form of chlorinated lime, is quite frequently used in the disinfection and purification of drinking water. It has been found that water containing not more than 1 part of the gas in 1,000,000 is not especially harmful to man.

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<sup>12</sup>*Edema* (or oedema), swelling due to fluid in the tissue.

## CHAPTER V

### PURGATIVES

In caring for the sick, one of the conditions most frequently found needing attention is the emptying of the bowels. Simple or chronic constipation is found in the great majority of sick people, and in some cases it is an important factor in causing the illness from which they suffer. No other class of drugs is used so much without medical advice as the purgatives, and the number of remedies on the market for this purpose is very large.

A number of terms are used to express different degrees of purgative action. An *aperient* is a very mild purgative; a *laxative* is a little more effective; a *cathartic* causes several watery stools and a *drastic* causes severe griping, distress, and frequent stools. A *hydragogue* causes very watery stools, and a *cholagogue* causes the appearance of bile in the passages.

#### Mild Aperients

Castor oil, (oleum ricini), dose,  $\frac{1}{2}$  oz.

Phenolphthalein, dose, 2 gr.

Sulphur, dose, 1 dr.

Glycerine suppositories.

Castor oil is obtained from the castor bean which contains an irritant poison that does not pass into the oil. This oil has a disagreeable taste and is given in many ways to try to hide the taste. It is often flavored with one of the volatile oils, or given in milk, wine,

fruit juice, or glycerine. A movement of the bowels may be expected in four or five hours, so castor oil should not, as a rule, be given at bed time.

Phenolphthalein is not soluble in water and is usually given in tablets. As it has no taste it is easily given to children, often in the form of a candy. It is very mild, and in obstinate constipation may not have any laxative effect. It takes twelve hours or more to cause a bowel movement, but the effect may last for several days. Phenolphthalein is red in alkaline solutions and may make the urine red when alkaline.

Sulphur has a mild purgative action when given by mouth, but is seldom so used on account of the disagreeable odor it gives the breath. *Sulphur ointment* is used on the skin to destroy the parasite which causes itch (scabies).

Glycerine by mouth may produce some laxative effect, but it is used mostly in the form of a suppository, to produce a prompt bowel movement. Pure glycerine injected into the rectum will have the same effect.

### Mild Vegetable Purgatives

Rhubarb, senna, aloes and cascara all contain similar substances that act slowly upon the bowel. Rhubarb is a fleshy root. Senna is the leaves of a tropical shrub. Aloes is the dried juice of a tropical plant. Cascara is the bark of the California buckthorn bush.

#### Preparations and Doses.—

Compound rhubarb powder, dose, 30 gr.

Syrup of senna, dose, 1 dr.

Aloes pills, dose, 1 or 2 pills.

Aloin (obtained from aloes), dose,  $\frac{1}{4}$  gr.

Fluid extract of cascara, dose, 15 m.

Aromatic cascara (variable), dose, 15-60 m.

A. B. S. tablets, dose, 1 or 2 tablets. (They contain aloin, strychnine, and belladonna.)

This group is the most widely used of all the purgatives. There are a great many official preparations of these drugs, but it does not seem necessary to mention



Fig. 2.—Senna leaves, *a* and *b*. The others are accidental impurities found among senna leaves. (From Wall's *Pharmacognosy*.)

all of them. Senna is often used as a home remedy by making a tea from the leaves. It is the chief laxative in most of the widely advertised fluid preparations, such as castoria and syrup of figs. Aloin is the laxative most frequently used in making pills and tablets of various kinds which are advertised and sold as purgatives.

All the laxatives of this group are rather slow and are usually given at bedtime. They seldom produce results in less than 10 to 12 hours. Although their action is mild, they may cause some griping when given in large doses. None of these should be given to the nursing mother as some of their constituents pass into the milk and may affect the child unfavorably.

When aloin is injected subcutaneously it causes contraction of the uterus. As some of it may be absorbed from the bowel, it should not be used as a laxative in pregnancy or during menstruation.

Rhubarb contains a good deal of tannic acid and small doses are sometimes used in the treatment of diarrhea.

Cascara is probably the best laxative for use in chronic constipation as it does not lose its efficiency when taken for a long time.

### Saline Purgatives

Most sulphates, phosphates, citrates and tartrates are very slowly absorbed from the bowel, and, as they also keep the water in the bowel from being absorbed, they increase the amount of fluid entering the colon, thus hastening its movements and causing watery passages.

#### Preparations and Doses.—

Epsom salts (magnesium sulphate), dose,  
 $\frac{1}{2}$  oz.

Glauber's salts (sodium sulphate), dose,  
 $\frac{1}{2}$  oz.

Rochelle salts (potassium sodium tartrate),  
dose, 2 dr.

Sodium phosphate, dose, 1 dr.

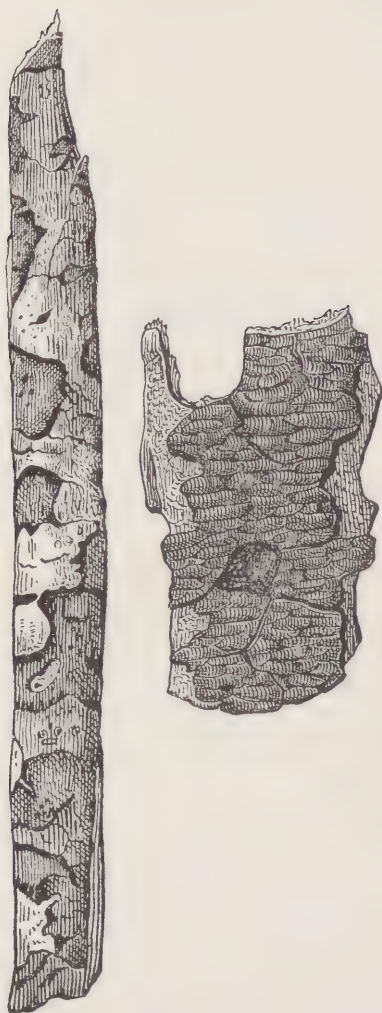


Fig. 3.—Cascara sagrada bark. (From Wall's *Pharmacognosy*.)

Magnesia (magnesium oxide), dose, 30 gr.

Magnesium carbonate, dose, 30 gr.

All of these salines, except the magnesias, are soluble in water and are given in solution by mouth. The Epsom and Glauber salts have a harsh disagreeable taste, and are often called bitter salts. The others are not so unpleasant and the magnesias are tasteless.

### Saline Effervescing<sup>13</sup> Preparations

Seidlitz powder, dose, one of each given together.

Magnesium citrate solution, dose, 12 oz.

Effervescing sodium phosphate, dose, 2 dr.

A seidlitz powder consists of the contents of two papers, a blue one, containing Rochelle salt and baking soda, and a white one containing tartaric acid. When dissolved in separate glasses of water and mixed, they bubble and foam and are then ready to be taken. Magnesium citrate solution contains gas held in a tightly corked bottle, something like pop. When the cork is removed it bubbles and foams and is ready to be swallowed. The effervescing sodium phosphate is a dry granular powder which bubbles and foams when put into water.

When taken on an empty stomach, as before breakfast, the salines may produce a bowel movement in an hour or less. When taken after a meal the action takes longer, from two to four hours or more. Salines are not irritating to the bowel, and their prompt action makes them very useful in simple constipation. In the more chronic conditions the dilute mineral waters are more useful than the stronger solutions of these salts.

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<sup>13</sup>*Effervescing*, bubbling and giving off gas.



After a dose of calomel, a saline is often given to ensure a movement without too much delay.

The magnesias are discussed in the section on alkalies.

### Drastic Purgatives

With the exception of croton oil, the drugs of this group yield resins<sup>14</sup> that are irritant to the bowel and cause prompt movements often with colicky pains and distress. They are colocynth, (bitter apple), podophyllum (May apple root), jalap root, scammony root, enonymus (wahoo root bark), elaterium (from the

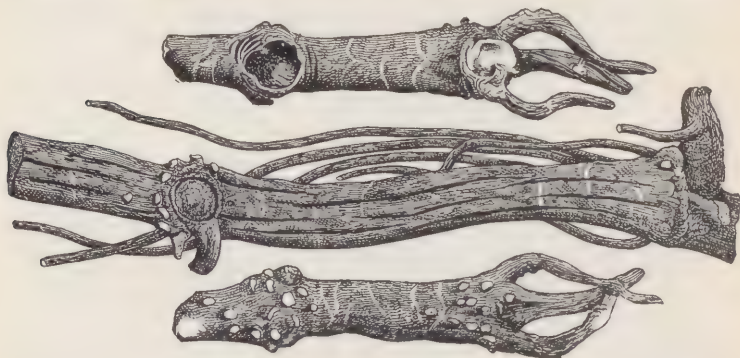


Fig. 4—Root of podophyllum, also called mandrake or May apple. (From Wall's *Pharmacognosy*.)

squirting cucumber) and gamboge resin. As they are seldom used alone but mostly in pills along with other purgatives, only a few of their preparations will be mentioned.

### Preparations and Doses.—

Compound cathartic pills, dose, 1 or 2 pills.

Croton oil (*oleum tiglii*), dose, 1 m.

Compound jalap powder, dose, 30 gr.

<sup>14</sup>*Resins*, hard, brittle, plant products, insoluble in water but soluble in alcohol and ether.

The compound cathartic pill contains calomel in addition to several of this group. It is very harsh and severe in action and should be used only in obstinate



Fig. 5.—Jalap root, a tuberous root. (From Wall's *Pharmacognosy*.)

constipation. Croton oil is a rapid, drastic purgative. It causes severe irritation of the bowel, and griping with frequent watery stools may continue for hours. It should only be used in emergencies where no other

purgative will serve the purpose. The compound jalap powder is usually prompt and effective, although rather harsh in action.

Members of this group should be used only in obstinate constipation where salines or mild purgatives have no effect. In large doses they all act in two to four hours except podophyllum which takes ten to twenty hours. Their continued use is liable to cause inflammation of the inner lining of the bowel.

## CHAPTER VI

### ANODYNES

#### Opium and Morphine

Opium is one of the oldest remedies known to man. It was used by the Chinese long before the time of Christ and is still very commonly used among them. It

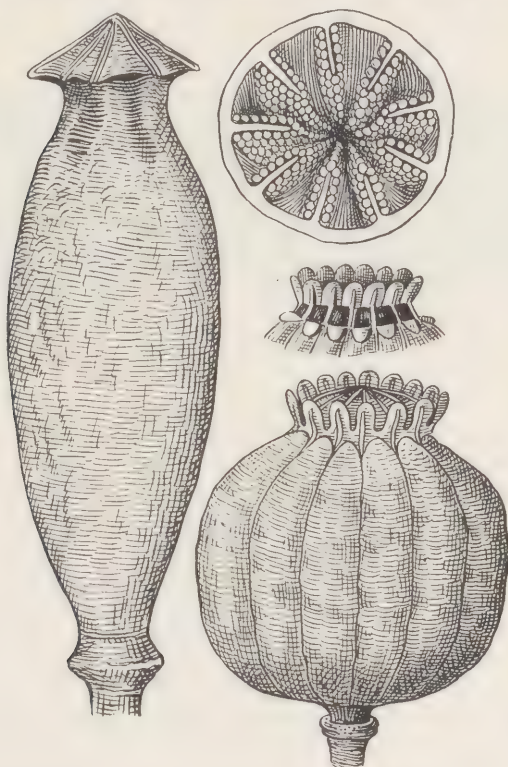


Fig. 6.—Capsules of the opium poppy of various shapes, also a cross section. (From Wall's *Pharmacognosy*.)

is probably the most important remedy known and no real substitute for it has been discovered.

Opium is the dried juice of the seed capsule of a species of poppy. It is obtained mostly from India, China, Arabia, Egypt, and Turkey. It is made up of a large number of substances, but the most important are two alkaloids,<sup>15</sup> morphine and codeine. The effects of opium are mostly due to the morphine in it.

### Preparations and Doses.—

Morphine sulphate, dose,  $\frac{1}{8}$  to  $\frac{1}{4}$  gr.

Codeine phosphate, dose,  $\frac{1}{2}$  gr.

Pills of opium, dose, 1 pill.

Powdered opium, ( $10\frac{1}{2}$  per cent morphine)  
dose, 1 gr.

Dover's powder (contains ipecac), dose, 8 gr.

Paregoric<sup>16</sup> (camphorated tincture), dose,  
1-2 dr.

Morphine and codeine are used by mouth as well as hypodermically. Preparations of opium are given by mouth in solution or in pill, tablet or dry powder.

**Action and Uses.**—The chief effect and use of opium and morphine is to relieve pain. They do this more efficiently than any other known medicine. Small doses may relieve pain without any other noticeable effect, though usually some sleepiness is felt. Large ordinary doses not only relieve pain but cause a distinct feeling of dullness and sleepiness although the mind may remain clear and active. Such doses also slow the respiration

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<sup>15</sup>*Alkaloids*, pure substances obtained chiefly from plants and resembling alkalies to some extent. Many of them are active poisons and most of them are the true medicinal substance of the plant from which they come.

<sup>16</sup>*Paregoric* is intended chiefly for children. It contains very little opium and some camphor with other ingredients. To a child of one month 5 drops can usually be given safely and to older children in proportion.

somewhat and lessen secretions and movements of the bowels (chiefly the colon) causing constipation. There is a slight flushing of the skin and some contraction of the pupil. Such doses have little or no effect on the heart or circulation so long as respiration supplies enough oxygen.

Codeine is much weaker than morphine and requires about four times as much to give similar results. Its effects are briefer and the sleep resulting from it is not so deep or restful. It does not affect the respiration or bowel as much as morphine and is much less dangerous to life.

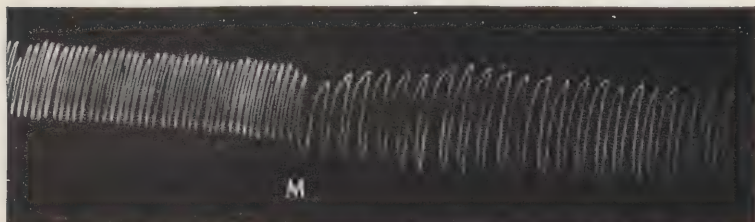


Fig. 7.—Tracing showing the effect of morphine on the respiration of a cat. *M* shows where morphine was injected. (From Cushny's *Pharmacology and Therapeutics*.)

Heroine, an alkaloid made from morphine, is used chiefly in the treatment of coughs. It is more powerful than morphine and is given in much smaller doses.

Quite frequently the giving of morphine will cause vomiting even though used hypodermically. This result occurs most frequently as the effect of the drug is wearing off. Apomorphine, another alkaloid derived from morphine, always causes vomiting quite promptly when given hypodermically, and less promptly by mouth. It is our most efficient emetic. When given in doses too small to cause vomiting, it is soothing and relaxing to nerves and muscles and increases bronchial secretion.



Heroine hydrochloride, dose,  $\frac{1}{24}$ - $\frac{1}{12}$  gr.

Apomorphine hydrochloride, emetic dose,  $\frac{1}{10}$  gr.

Sedative and expectorant dose,  $\frac{1}{40}$ - $\frac{1}{30}$  gr.

**Poisoning** with opium or morphine has occurred very frequently. Probably 40 per cent of all fatal poisonings are from these drugs. Many cases result from medicinal overdoses or accident as well as from suicide or homicide. Children under one year old are easily

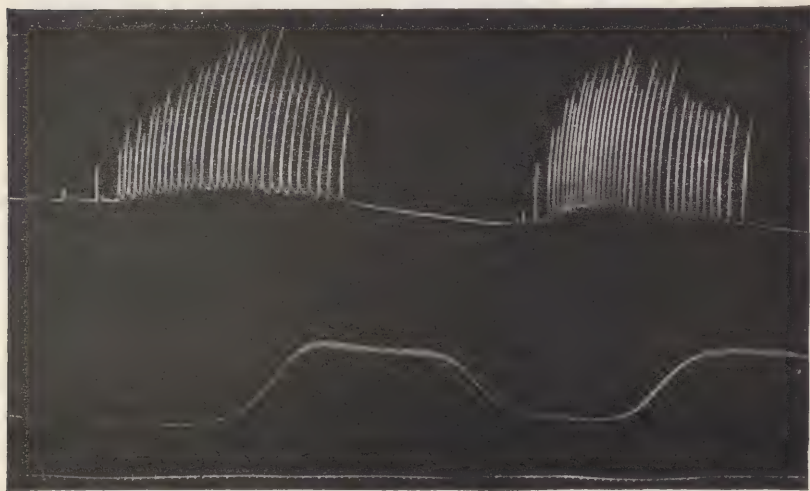


Fig. 8.—Tracing of the respiration (upper) and blood pressure (lower) of a cat during Cheyne-Stokes' respiration due to morphine. (Barbour.) (From Cushny's *Pharmacology and Therapeutics*.)

poisoned. A case of death in such a child from one drop of laudanum has been reported. Patent medicines containing opium or morphine have often caused poisoning.

**The chief symptoms** are deep sleep from which the person can not be awakened, slow breathing, sometimes shallow, and becoming irregular toward a fatal end



(Cheyne-Stokes' respiration).<sup>17</sup> The pupils are contracted to mere specks but dilate widely before death. The skin is moist but cold. As the breathing becomes weaker, cyanosis<sup>18</sup> comes on and death results from failure of respiration. If opium has been taken, the odor may be detected in the breath. Morphine has no odor.

The deep sleep of opium poisoning may be mistaken for drunkenness or other form of unconsciousness, but the narrow pupil, slow breathing, and perhaps the odor of the breath should help to recognize it.

**Treatment.**—Empty the stomach with a siphon tube or stomach pump, and wash it out with tannic acid (strong tea) or very dilute permanganate of potash solution. Do not give an emetic as, usually, it will not work. Give strong tea or black coffee through the stomach tube before removing it, or per rectum, and as hot as is safe. A good saline purge, given through the tube, is a decided aid in eliminating the drug. If breathing shows signs of failure some form of artificial respiration should be used as the life depends on keeping the patient breathing. Strychnine or atropine may be used to stimulate the respiration. Keep the patient warm but admit plenty of fresh air.

**Opium or Morphine Habit.**—Frequent repeated doses of these drugs not only lead to marked tolerance but to a very strong desire for the drug which the victim seems powerless to resist. The results vary in different individuals, but in general, long continued use leads to depression and weakness, not only of the body, but also of the mind and even the morals. The Chinese seem to

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<sup>17</sup>*Cheyne-Stokes' respiration* (so called from the men who first described it), is an alternate increase and decrease in the depth of respiration.

<sup>18</sup>*Cyanosis*, a bluish appearance of the lips and face due to lack of oxygen in the blood.

suffer much less than the Caucasian race from long use of these drugs.

**Codeine** has little tendency to form a habit, but heroine does cause habit and has often been substituted when morphine could not be obtained.

### **Cannabis**

Many of the natives of Southern Asia and Northern Africa have used hashish (hemp) as an intoxicant for centuries. Some smoke it alone or with tobacco or opium, others chew it and still others make a drink from it. Some tolerance is acquired in a short time, but cannabis is much less harmful than opium.

Cannabis (until recently called Cannabis Indica) is the flowering tops of hemp grown in hot countries. The same plant cultivated in colder climates has little or no effect.

#### **Preparations and Doses.—**

Extract of cannabis, dose,  $\frac{1}{2}$  gr.

Tincture of cannabis, dose, 15 m.

**Action and Uses.**—The effects of cannabis on Asiatic races are different from those on Western peoples. Under its influence orientals become drowsy and have vivid dreams of a most extravagant nature, seeing visions of rare beauty and experiencing many wonderful delights. Among the less imaginative Europeans, similar amounts of the drug may cause only a tendency to sleep, though many show symptoms of excitement and causeless merriment. In all there is a lessened sense of pain and a feeling of comfort and satisfaction. This usually passes into a quiet sleep from which the person awakes refreshed and happy.

The uses of cannabis are rather limited. It is used as a hypnotic but results are rather uncertain. Some kinds of headache are relieved by it, and in moderately severe pain, where opium may not be used, it often gives some relief, but it is much less effective than opium.

## CHAPTER VII

### GENERAL ANESTHETICS

#### **Ether and Chloroform**

The practice of causing complete unconsciousness during surgical operations began in this country in 1864 when ether was first used by Jackson and Morton. The next year Simpson in England used chloroform for the same purpose and since that time both have been in general use.

Both ether and chloroform are clear, colorless, volatile liquids made from alcohol by chemical processes. The taste of ether is pungent and bitter and its odor unpleasant. It is more volatile than chloroform, burns readily and its vapor is explosive. Chloroform has a rather sweetish taste, a not unpleasant odor, and does not ignite readily.

**Preparations and Doses.**—These remedies are usually given by the lungs in the form of vapor and the percentage of their vapor in the inspired air is the measure of dosage. About 1 per cent of chloroform and  $3\frac{1}{2}$  per cent of ether vapor in air will maintain anesthesia but more is required to produce it.

These remedies are also used by mouth, or externally sometimes, and the following preparations are intended for such uses.

Spirits of chloroform; dose, 30 minims.

Spirits of ether (Hoffman's Drops), dose,  
30 minims.

Chloroform water.

Chloroform liniment.

**Action and Uses.**—Applied externally, ether and chloroform are cooling, irritating, and antiseptic. Small amounts by mouth are carminative.<sup>19</sup>

Their action as general anesthetics is usually considered as in three stages, which are not definitely marked but shade into one another.

1. Stage of diminished consciousness.
2. Stage of excitement.
3. Stage of complete unconsciousness.

*First Stage.*—The first breaths of the vapor usually cause a choking sensation and the breath is often held for a while. This can largely be avoided by a careful giving of very dilute vapor, at first, and gradually increasing it. As inhalation of the anesthetic continues the senses gradually become less acute and the limbs feel heavy and are moved with difficulty. Children frequently resist violently during this stage.

*Second Stage.*—In this stage the patient has largely lost consciousness and seldom retains any memory of it. It is not always seen in adults and is usually absent with children. In some people there is merely a tremor or a few movements, but in others, especially habitual users of alcohol, there is wild excitement and violent movements. The patient may struggle, sing, shout, laugh, swear or talk. The pulse and respiration become increased and the face flushed or cyanotic. To some extent, the excitement is due to the surroundings and visible preparations for an operation. When the anesthetic is taken quietly in the privacy of the home, excitement is rarely seen.

*Third Stage.*—In this stage the muscles relax, the reflexes<sup>20</sup> are largely absent and the pupils contract

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<sup>19</sup>*Carminative*, relieving flatulence and gastric distress.

<sup>20</sup>*Reflexes*, involuntary responses to external influences.

slightly as in normal sleep. The respiration becomes slower and less deep. If ether be used, the pulse remains full and strong, but with chloroform it is weaker and the blood pressure falls. The face is calm and expressionless, slightly flushed or even cyanotic from ether, but rather pale from chloroform. Vomiting is very likely to occur, either before complete unconsciousness or on partial recovery. The secretion of bronchial mucus and saliva is much increased by ether, less by chloroform.

Careful experiments on animals have shown that chloroform is 25 to 30 times more injurious to the heart muscle than the same amount of ether.

During the third stage, when the pupils are moderately contracted, sudden wide dilatation is a sign of possible danger, as it may mean the beginning of asphyxia,<sup>21</sup> or it may mean returning consciousness. The contractions of the uterus during labor are not much affected by moderate anesthesia but they are slowed and lessened in force by deep narcosis.<sup>22</sup> The body temperature falls even during a short anesthesia, and may be reduced several degrees during long operations.

**Choice of Anesthetic.**—Ether is much the safer anesthetic, and should be the one of choice unless some good reason exists for not giving it. It may be necessary to give chloroform to habitual drinkers of alcohol as they often become excited, but not unconscious, from ether. When some irritation or inflammation of the respiratory passages exists, chloroform will be less likely to increase it than ether. Chloroform can be used safely in the presence of an open flame, whereas ether is liable to ignite or explode. Lastly, ether is too easily vapor-

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<sup>21</sup>*Asphyxia*, suffocation, lack of oxygen.

<sup>22</sup>*Narcosis*, deep unconsciousness due to a drug.

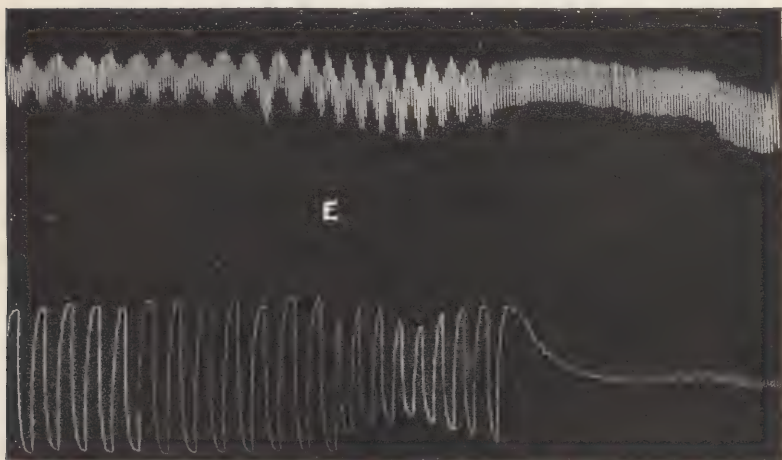
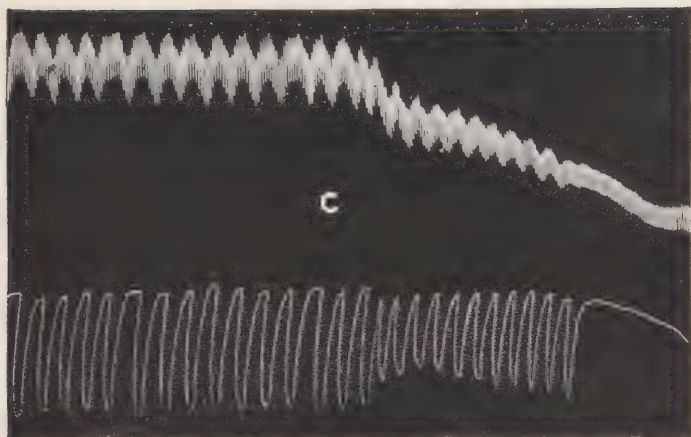


Fig. 9.—Tracings of action of ether and chloroform on blood pressure of cat. Upper tracing in each is blood pressure, lower is respiration. Note the condition of blood pressure in each when respiration stopped. (From Cushny's *Pharmacology and Therapeutics*.)



ized to be kept and used in very hot climates, as it boils about 95° F., but chloroform remains liquid at a much higher temperature.

**Dangers of Anesthesia.**—The mental state of the patient, when the anesthetic is given, has much to do with a favorable outcome. The depressing emotions of fear, anger, hatred, worry, and grief are injurious to the patient, but confidence, peace, joy, love, and hope are important aids in bringing about a satisfactory result. When cheerful conversation and a hopeful attitude on the part of nurse and attendants fail to calm the patient, a small dose of morphine an hour or two before the time for anesthesia will often relieve the troubled mind.

**A foreign substance** in the respiratory passages is always a possible source of danger. Gum, tobacco, false teeth, saliva, mucus or vomited matter may get into the larynx and trachea, and must be guarded against.

**Sudden heart failure** from chloroform is a possibility that should always be kept in mind, although not a very frequent occurrence. This may happen quite early in anesthesia, sometimes before unconsciousness, and the patient may die before restorative measures can be applied. This danger seems to be absent when ether is used.

**Ether or chloroform poisoning** is the chief danger to be avoided. Giving too much of the anesthetic is probably the cause of most fatal anesthesia accidents and of many of the unpleasant after-effects. The most frequent result is failure of respiration. The breathing becomes shallow and irregular, cyanosis develops and the pupils dilate, and finally breathing ceases. If the heart is still beating, prompt and energetic measures will usually restore the respiration and save a life.

**Treatment.**—As low blood pressure may be the cause of the stopping of respiration, the head of the patient should be lowered and the limbs elevated. This permits gravity to bring more blood to the brain. The mouth and larynx should be freed from any possible obstruction, and some form of artificial or forced respiration should be started at once. Reflex stimulation, by slapping the skin or subcutaneous injection of some irritant, may be tried and sometimes gives good results. Strychnine, caffeine or atropine hypodermically or intravenously will stimulate the respiration if the circulation can carry the drug to the center. Adrenalin will raise the blood pressure but in heart failure may help to produce fibrillation.<sup>23</sup>

Many recent improvements in methods of giving anesthetics have been proposed. Apparatus for measuring and controlling the amount of ether or chloroform vapor inhaled has been devised. Measures for supplying the necessary amount of oxygen and moisture and for warming the inspired vapor have been used. Intravenous injection of ether dissolved in warm saline solution has been tried but is liable to damage blood corpuscles. Mixtures of ether and oil have been given by mouth and by rectum, and the vapor of anesthetics has been passed into the trachea through a tube.

The details of giving anesthetics are best learned at the bedside and in the operating room and would be out of place here, but the simpler methods of dropping the anesthetic upon a gauze mask or towel have caused no more deaths than the more complicated ones. **Simplicity, experience and watchfulness** are the essentials of successful anesthesia.

When the patient has been returned to bed and has

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<sup>23</sup>*Fibrillation*, muscle tremors due to the fibers contracting independently.

regained consciousness, the dangers from the anesthetic are not all over. Fatty changes in the heart and other organs, and the presence of albumin in the urine are often seen after chloroform, while serious bronchitis or pneumonia may follow the giving of ether.

### Nitrous Oxide—Laughing Gas

When nitrous oxide is inhaled mixed with air, it produces a condition similar to a certain stage of drunk-

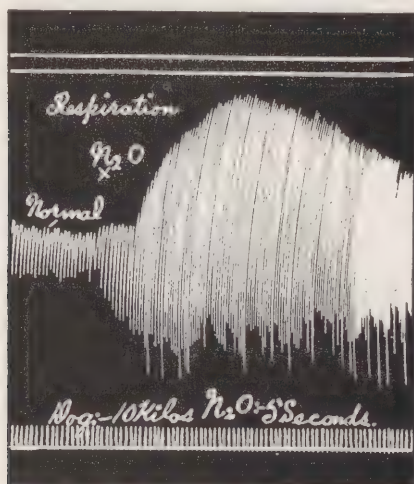


Fig. 10.—Effect of nitrous oxide on normal breathing. (From Jackson's *Experimental Pharmacology*.)

enness. The person inhaling it feels merry and good-natured, laughs and talks, but does not go to sleep.

When the pure gas is inhaled, there is a very brief period of excitement passing quickly into unconsciousness with cyanosis, and if continued, death soon results from asphyxia. If the inhalation of gas is stopped

before marked cyanosis comes on, there is rapid return to consciousness with no after-effects. A safe anesthesia of only from 30 to 60 seconds is possible by this method which is used mostly in dentistry.

More prolonged anesthesia with nitrous oxide can be safely produced by giving the necessary amount of oxygen along with the gas. Appliances are in use for giving these together and increasing or reducing the proportion of either one as the patient's condition requires. Quite prolonged surgical operations have been performed with this method of anesthesia and it is comparatively safe, but the apparatus is cumbersome, the cost of the compressed gases is considerable and relaxation of muscles is not complete as under ether or chloroform.

### **Ethyl Chloride**

Ethyl chloride, a very volatile liquid, has been tried as an anesthetic and will cause unconsciousness about as rapidly as nitrous oxide. However it is used mostly for local anesthesia by freezing the tissue when applied in a fine spray. (For tracing, see Fig. 11, p. 68.)

## CHAPTER VIII

### ALCOHOL

Since the earliest days of mankind alcohol in some form has been used as a medicine as well as a beverage, and its usefulness as a remedy and harmfulness as a

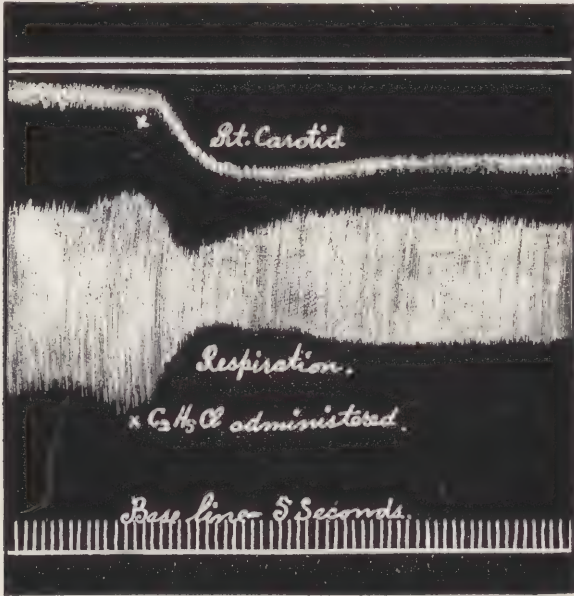


Fig. 11.—Tracing showing the change in blood pressure (upper) and respiration (lower) when an animal under nitrous oxide inhales ethyl chloride. (From Jackson's *Experimental Pharmacology*.)

poison have been themes for endless discussion and rhetoric.

Alcohol is made by the action of yeast on sugar and it retains some of the food qualities of the sugar. It is

a clear, colorless volatile liquid with a hot, biting taste and very little odor. The smell of ordinary alcoholic drinks, and that from the breath of hard drinkers, is not due to alcohol but to other volatile substances.

**Preparations.—**

Alcohol, 92.3 per cent by weight.

Absolute alcohol,<sup>24</sup> over 99 per cent alcohol.

Dilute alcohol, about 41 per cent alcohol.

Whiskey and Brandy are about the same strength as dilute alcohol and are used for internal administration.

The medicinal dose of alcohol is about half an ounce well diluted for those not accustomed to it. The quantity of any alcoholic preparation containing this amount would be a suitable dose.

**Action and Uses.**—Locally applied, alcohol is mildly irritating and cooling to the skin. Strong solutions are efficiently antiseptic and penetrate tissue well but are too irritating for use in wounds and on delicate surfaces. Such solutions are used to harden and toughen the skin where exposed to pressure or mechanical irritation. In the stomach, strong alcohol is irritating and frequently causes nausea and vomiting. Continued drinking has a hardening effect on the stomach lining similar to that on the skin, and secretion and digestion are often much impaired. Dilute solutions are carminative when swallowed, have little irritating effect, but are cooling when applied to the skin.

The irritating effect of strong alcoholic solutions on the mouth and throat while being swallowed, is often used as a means of reflex stimulation in fainting and respiratory weakness.

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<sup>24</sup>*Absolute alcohol*, (now called dehydrated alcohol), alcohol free from water.



Alcohol is not a stimulant to the nervous system, but a depressant, for it lessens the efficiency of the work done by it. Moderate amounts often cause an increased feeling of comfort and a lessened consciousness of unpleasant things with a feeling of mental and physical vigor that is misleading, for careful tests have shown that nearly always the ability to do careful mental or physical work is reduced.

Larger amounts frequently cause excitement, but, when taken in quiet and privacy, sleep more often results than excitement. The flushing of the face is due to a dilating action on surface blood vessels, but, unless excitement occurs, moderate amounts of alcohol have little effect on the heart, and blood pressure is not much changed in any way. When excitement comes on it is shown in different ways; some become loudly talkative, some affectionate or tearful, others angry and quarrelsome. A lack of judgment is shown by furious outbursts of anger at trivial matters. Self-control is lost and the impulse of the moment directs the actions. The walk becomes unsteady and the speech thick and indistinct. If still larger amounts be taken, a deep sleep or complete unconsciousness like that of ether anesthesia results. The muscles are relaxed, there is absence of reflexes, slow respiration and a fall in body temperature. This condition is popularly called "dead drunk;" it is really alcohol poisoning. The heart may be much weakened at this stage and death may result. When not fatal, the return to consciousness is slow and accompanied by great depression of mind and body, weakness, nausea, headache and thirst.

That alcohol is a food has often been questioned, but is now quite well established. When moderate amounts, at proper intervals and well diluted, are taken,



the greater part of it is oxidized in the body and furnishes heat and working energy. This prevents a waste of body tissues when enough food can not be taken, and to some extent takes the place of ordinary food. Alcohol should therefore be of value in sickness where



Fig. 12.—Tracings showing the effect of a strong solution (50 per cent) of alcohol on the heart of a dog. Upper tracing the auricle, lower the ventricle. Read from right to left. (From Cushny's *Pharmacology and Therapeutics*.)

enough ordinary food can not be taken or digested. Alcohol needs no digestion. It is not stored up in the body for future use like fats and starches but is used at once. It is an emergency food only and its habitual use by healthy people is unnecessary and often harmful by its

influence on the nervous system and the danger of forming a habit.

The natural resistance of the body against infection is lowered by the continued use of alcohol. Not only does this use increase the likelihood of infection, but it also lessens the chance of recovery. The high mortality from pneumonia among alcoholic addicts<sup>25</sup> is a well-known example.

Dilute alcoholic solutions, such as wines and beer, are sometimes of value in indigestion or lack of appetite. The result will depend largely on whether the beverage is relished by the patient or not. If disliked the benefit is doubtful.

**Poisoning.**—The person unconscious from alcohol, usually said to be “dead drunk,” is suffering from poisoning just as truly as the victim of opium or carbolic acid poisoning, and should be so regarded. The practice of leaving such a person all night on the cold floor of a cell in a police station is responsible for many deaths. The moral phase of drunkenness does not directly concern the physician or nurse whose duty it is to save life under any circumstances.

**Treatment.**—The person overcome by alcohol should be put in a warm bed and the stomach emptied by means of a stomach tube or an emetic. Stimulation with caffeine or strychnine may be necessary, but ordinarily keeping the body warm is all that is necessary.

**Alcohol Habit.**—Chronic alcoholism is a habit that is acquired very readily by some and not at all by others. The degree of tolerance developed by long indulgence is only moderate, when compared with that for morphine or cocaine, and the strength of the habit is

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<sup>25</sup>*Addicts*, those persistently devoted to something harmful.

Fig. 13.—Tracing showing the slight effect of a moderate amount of alcohol on the heart (upper) and blood pressure (lower) of a dog. White mark shows where alcohol was injected. Read left to right. (Courtesy, A. N. Richards, Pharmacological Laboratory, University of Pennsylvania.)



usually less, but in most cases the unaided will of the victim is not enough to overcome it.

The evil effects of long and excessive use of alcohol are very extensive. When strong spirits are used, the digestion is usually injured and nutrition impaired. Often a weakened condition of the blood vessels results, and this favors their rupture, especially in the brain, causing apoplexy.<sup>26</sup> The effects on the nervous system are most marked and lead to loss of memory, self-control, and rational thinking, often ending in some form of insanity. Those who indulge in excessive use of beer and other dilute forms of alcohol are often very fat, are usually lazy and generally inefficient, but are less seriously affected than the drinkers of strong spirits.

**Delirium tremens** is a condition often seen in hard drinkers. The symptoms usually are sleeplessness, nervous excitement, causeless fear, muscular tremors, and seeing or hearing things that do not exist.

**Treatment.**—Delirium tremens needs careful nursing, warmth, good nourishing food, and sedatives to bring on sleep and control the excitement. Opium and chloral hydrate are perhaps the most useful remedies.

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<sup>26</sup>*Apoplexy*, sudden paralysis from hemorrhage in the brain.

## CHAPTER IX

### SOPORIFICS OR HYPNOTICS

When the tired mind or body fails to obtain rest in natural sleep, it becomes necessary to use some means of producing sleep, and certain drugs are often used for this purpose. Opium is the oldest of this class of drugs, but the tendency to habit formation makes the use of opium unwise except when pain is the cause of insomnia. The drugs now most frequently used as hypnotics are comparatively new in medicine.

#### **Preparations and Doses.—**

Choral hydrate, dose, 15 gr.

Paraldehyde, dose, 30 m.

Sulphonal, dose, 12 gr.

Trional, dose, 12 gr.

Veronal, dose, 5 gr.

Chloretone, dose, 5 gr.

**Chloral hydrate** is best given dissolved in water or syrup. It should not be dispensed<sup>27</sup> in capsules or powders. Paraldehyde is a liquid. It can be put in capsules or dissolved in quite an excess of water. Sulphonal, trional and veronal are usually given as tablets or in powders. They are insoluble in cold water but can be dissolved in very hot water or milk.

**Action and Uses.**—Locally chloral hydrate is quite irritant and its solutions should always be well diluted before using.

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<sup>27</sup>*Dispense*, to prepare and distribute to those who use it.

After absorption, all of this group are sedative and depressant to the central nervous system, thus producing a condition favoring sleep. Ordinary doses have very little effect on pain, but the respiration is slowed somewhat and the reflexes are lessened. Chloral hydrate lowers blood pressure somewhat and tends to weaken the heart as chloroform does. Paraldehyde does not depress the heart and is a very safe hypnotic, but it has a disagreeable odor and unpleasant taste. Veronal is effective in smaller doses than any other of this series and is perhaps the best. It has been found of value in vomiting of pregnancy, seasickness, and other kinds of reflex vomiting. All of these remedies are useful, not only in sleeplessness, but also in many forms of mental and motor excitement such as delirium, mania,<sup>28</sup> and convulsions of various kinds.

**Chloretone** is a white crystalline solid resembling chloral hydrate but only slightly soluble in water. It is a hypnotic, antiseptic and local anesthetic. It is of value in checking persistent vomiting due to irritation of the stomach. It can be used as a dusting powder for the relief of pain in burns, ulcers, or painful wounds.

Many other substances have been proposed and tried as hypnotics, but they seem to have no advantage over those mentioned here. The bromides, cannabis, hyoscine and alcohol belong to this group also, but are discussed elsewhere.

**Poisoning.**—Sulphonal and trional are not very apt to cause fatal poisoning, but their long-continued use has a harmful effect on the blood, especially in anemic persons. Chloral hydrate has frequently proved fatal from overdosage. It has been used as “knock-out drops” by criminals, as its taste is not easily noticed

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<sup>28</sup>*Mania*, a variety of insanity with wild excitement.



in alcoholic drinks, and it is absorbed very rapidly when dissolved in alcohol.

**The symptoms** of poisoning with large doses of chloral hydrate are much like those of anesthesia. The victim is more or less unconscious and can not be aroused, the breathing is slow and snoring, the pulse is slow and weak, the muscles are all relaxed, the reflexes absent, and the skin cool and moist.

**Treatment.**—Empty the stomach thoroughly with a stomach tube. Emetics in this condition are unreliable. Stimulate the respiration with caffeine or strychnine, and apply external heat as after anesthesia. If necessary use artificial respiration.

**Tolerance** for any of these remedies will result from long use and tolerance for any one of them may make larger doses of others necessary to get results. Alcoholics usually require larger than ordinary doses of these remedies.

**Habituation** to chloral hydrate has occurred and the habit has been about as difficult to overcome as alcoholism.

### Bromides

**Potassium Bromide** has long been in use in the treatment of nervous disorders. The use of other bromides in medicine is more recent.

#### **Preparations and Doses.**—

Potassium bromide, dose, 20 gr.

Sodium bromide, dose, 20 gr.

Ammonium bromide, dose, 20 gr.

These salts are all freely soluble in water and are usually given by mouth dissolved in water. Their taste is salty and bitter.



**Action and Uses.**—Bromides are nerve sedatives, that is, they lessen the activity of nerve centers. They cause drowsiness, mental dullness, and a feeling of fatigue. They do not compel sleep but help to bring it when pain is not the cause of sleeplessness. Bromide sleep is neither very deep nor refreshing and is often followed by a dull heavy headache. Pain is not much lessened by bromides in ordinary doses, but reflexes are quite noticeably diminished. The sexual instinct is lessened and may be entirely suppressed by large doses.

One of the earliest uses of bromides was in the treatment of epilepsy.<sup>29</sup> Few if any epileptics have been cured by these remedies, but the attacks are certainly rendered less severe and less frequent by their use, and sometimes are stopped entirely for a time. Chorea<sup>30</sup> and hysteria have also been relieved by bromides, and convulsions in children may often be controlled by them, but they are too weak to control the convulsions of tetanus<sup>31</sup> and strychnine poisoning.

**Chronic Poisoning (Bromism).**—Acute poisoning with bromides is not often seen, but long-continued use of large doses often brings on a condition of chronic poisoning called *bromism*. Skin eruptions are usually the earliest symptom of excessive use. They first appear as pimples, usually on the face, often becoming pustules and sometimes forming quite extensive sores. Instead of pimples there may be a redness of patches of the skin. Usually there is a loss of appetite and some disturbance of the stomach with an ill smelling breath. At times there is also an increased secretion of mucus in the bronchial tubes and the nose. The mind is sluggish and

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<sup>29</sup>*Epilepsy*, sudden fits of convulsions with unconsciousness.

<sup>30</sup>*Chorea*, (St. Vitus' dance), a nervous disease with involuntary jerky movements.

<sup>31</sup>*Tetanus*, (lockjaw), an infectious disease in which the muscles contract rigidly, especially those of the jaw.

the memory much weakened. The expression of the face is usually dull and stupid.

**Treatment.**—Cleanliness of the skin, mouth, and nose helps to prevent bromism, but when symptoms come on the dose of bromide should be reduced or the remedy entirely discontinued. The symptoms usually improve promptly when the drug is stopped, but common salt, given liberally with plenty of water, helps to get rid of the bromide more quickly.

## CHAPTER X

### STRYCHNINE AND CAFFEINE GROUP

#### **Nux Vomica and Strychnine**

In India and the East Indian Islands there grows a tree which produces a fruit containing large, grayish, disc-shaped seeds of a very poisonous nature. These seeds are variously known as poison nut, dog button and quaker button. Their medical name is nux vomica, and their medicinal and poisonous properties are due to an alkaloid called strychnine which they contain.



Fig. 14.—Nux vomica, also called poison nut, quaker button and dog button. (From Wall's *Pharmacognosy*.)

#### **Preparations and Doses.—**

Extract of nux vomica, dose,  $\frac{1}{4}$  gr.

Tincture of nux vomica, dose, 10 m.

The extract is usually given in pills and the tincture by mouth, frequently along with other remedies.

Nitrate of strychnine, dose,  $\frac{1}{60}$  gr.

Elixir of iron, quinine and strychnine phosphate (often written Elixir of I. Q. and S.), dose, 1 dr.

Strychnine nitrate and sulphate are given in solution or in tablet form, either by mouth or injected beneath the skin. The compound elixir is given by mouth only.

**Action and Uses.**—*Nux vomica* and strychnine are intensely bitter and are frequently used as bitter tonics to improve the appetite. After absorption, strychnine stimulates the central nervous system, making nerve centers more active than before. The mental activities are quickened, the special senses<sup>32</sup> are rendered more acute, movements are more easily performed and the respiration is increased. The heart is not stimulated by strychnine but the circulation may be improved by an increased activity of the vasomotor<sup>33</sup> center. All reflexes are made more active and responses to external influences are quickened and increased.

Strychnine is used extensively as a general stimulant in many forms of depressant poisoning and in many diseases where depression and weakness are present. Injected beneath the skin, it acts promptly and its action continues for a day or more.

**Poisoning.**—Strychnine has been responsible for a good many cases of poisoning with murder or suicide as a motive, as well as resulting from mistake or accident. Half a grain is the smallest dose known to have proved fatal to an adult. Children are very easily poisoned by it.

**Symptoms.**—The victim of strychnine poisoning often shows restlessness and uneasiness for a short time and complains of a feeling of stiffness in the muscles of the face and neck. The chief symptoms appear quite suddenly as general convulsions. The entire body becomes stiff from powerful contraction of all muscles. The

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<sup>32</sup>*Special senses*, seeing, hearing, smelling, tasting, and tactile (touch) sense.

<sup>33</sup>*Vasomotor center*, a group of nerve cells in the medulla that controls the movements of blood vessels.



Fig. 15.—Tracing showing the slight effect of strychnine on the heart (upper) and blood pressure (lower). White mark shows where strychnine was injected. (Courtesy, A. N. Richards, Pharmacological Laboratory, University of Pennsylvania.)

head and lower limbs are drawn backward giving the body an arched attitude known as opisthotonos. The face is distorted with a grinning expression called risus sardonius, and becomes flushed or cyanotic, as breathing is suspended due to contraction of the diaphragm. Death may result from the first convulsion, but usually, after a slight tremor of the muscles, the body relaxes and the breathing returns in hurried gasps. After a period of rest, varying from a few minutes to an hour, another convulsion of the same kind comes on, and periods of relaxation and spasm alternate until finally the respiration ceases. Death results usually within an hour or two after the onset of symptoms.

The convulsions are due to excessive stimulation of the cord and brain by strychnine. The victim is usually conscious to the end and suffers intense pain, frequently uttering sharp cries when breathing will permit. During a convulsion the blood pressure is very high, and rupture of a blood vessel in the brain may be the cause of death.

**Treatment.**—If the case is seen before convulsions have set in, the stomach should be thoroughly emptied by means of a rapid emetic such as apomorphine given hypodermically, or by means of a stomach tube, using a solution of tannic acid (tea leaves) as an antidote to retard absorption of the poison. If convulsions have appeared, chloroform or ether should be given by inhalation to prevent their return, but with care so as not to increase the danger to the patient's life. An emetic may be given hypodermically, but no attempt should be made to pass a stomach tube until the convulsions are under control. When the stomach has been emptied and the convulsions checked, chloral hydrate may be given per rectum to take the place of the volatile anes-



thetic in preventing convulsions. If the respiration fails at any time, artificial respiration by some approved method may be tried, or forced breathing with a pulmotor or similar device may be employed.

During treatment the patient should be in a cool, darkened room, and should be protected from any sudden noise, jar or change of any kind that would tend to bring on another spasm.

*Tolerance* for strychnine is very slight and there seems to be no tendency to habit when used for a long time.

### Caffeine and Theobromine

Caffeine is important not only as a remedy but also as a widely used article of diet. It has been estimated that three-fourths of the earth's inhabitants use something containing caffeine as a drink or food. Besides coffee and tea, which are very extensively used, the kola nut of Africa, the guarana paste of Brazil, the mate of Paraguay and the Apalache tea of Virginia and Carolina, furnish beverages and confections containing caffeine. From Central America we get the cocoa or chocolate seeds which contain theobromine, a substance similar to caffeine. These seeds are very extensively used in food, confections, and beverages.

### Preparations and Doses.—

Caffeine, dose, 3 gr.

Citrated caffeine, dose, 5 gr.

Caffeine sodio-benzoate, dose, 5 gr. by mouth, 3 gr. hypodermically.

Diuretin (Theobromine sodio-salicylate), dose, 15 gr.

Theocine (theophylline), dose, 4 gr.



Caffeine and theobromine are only slightly soluble in cold water, but dissolve readily in hot water. All of these remedies are given mostly by mouth in solution or as a powder or tablet. The caffeine sodio-benzoate is the only one suitable for hypodermic use as one grain of it dissolves in one minim of water.



Fig. 16.—Kola nuts. (From Wall's *Pharmacognosy*.)



Fig 17.—Cacao, cocoa, or chocolate bean. (From Wall's *Pharmacognosy*.)

**Action and Uses.**—Caffeine stimulates the central nervous system and more especially the mental faculties. After an ordinary dose the mind is clearer and more active, memory is better, thought quicker, and weariness less noticeable. There is also an increased feeling of bodily vigor and an actual increase in muscle power and ability to withstand fatigue. The respiration is stimulated and the rate of breathing increased. The

heartbeat is often increased, but the blood pressure is not much raised by ordinary doses as the blood vessels dilate.



Fig. 18.—Tracing showing the effect of caffeine, given at *C*, on the respiration of a rabbit under morphine. (From Cushny's *Pharmacology and Therapeutics*.)

Caffeine is used as a stimulant in all kinds of depression either from exhaustion or the poisonous action of drugs.

Fig. 19.—Tracing showing the effect of caffeine on the heart (upper) and blood pressure (lower). White mark shows where caffeine was injected. (Courtesy, A. N. Richards, Pharmacological Laboratory, University of Pennsylvania.)



Both caffeine and theobromine are diuretics and increase the flow of urine more than any other known drug. Theobromine, as diuretin, seems superior to caffeine for this purpose and is very frequently used as a diuretic.

**Tolerance** for caffeine results from continued use, and coffee or tea drinkers require larger doses than those not accustomed to it; but the tolerance is not very great. Habituation is not very marked and the desire for these beverages is easily overcome.

### Coffee and Tea

The aroma and flavor of both of these beverages is due to the volatile substances in them, not to caffeine; but the after-feeling of mental and bodily vigor is due to it. A good strong cup of either beverage will contain from  $1\frac{1}{2}$  to 3 grains of caffeine. Tea leaves contain about 7 per cent of tannic acid, and this makes tea a valuable antidote in many forms of poisoning, especially with alkaloids, which are made nearly insoluble by tannic acid.

Little harm usually results from moderate use of tea or coffee. Tannic acid tends to impair digestion and to cause constipation. Excessive use of tea or coffee is apt to overstimulate the mind and body and lead to final breakdown.

Chocolate or cocoa is injurious to the digestive function unless used very moderately. In fact it is well for persons with any digestive disturbance to exclude all of these beverages from their diet.

## CHAPTER XI

### ATROPINE AND PILOCARPINE GROUPS

#### **Belladonna or Atropine Group**

This group is composed of a number of plants and their alkaloids which resemble each other so much in the results they produce that they may well be studied together.

The chief alkaloids of this group are atropine, hyoscyamine and scopolamine or hyoscyne, the two last mentioned being usually considered as identical. They are found mostly in the leaves and roots of the following plants:

Belladonna, (deadly nightshade leaves).

Hyoscyamus, (henbane leaves).

Stramonium, (jimson weed or thornapple leaves).

Scopola, (Japanese belladonna root).

#### **Preparations and Doses.—**

Extract of stramonium, dose,  $\frac{1}{6}$  gr.

Extract of belladonna, dose,  $\frac{1}{4}$  gr.

Extract of hyoscyamus, dose, 1 gr.

Tincture of stramonium, dose, 8 m.

Tincture of belladonna leaves, dose, 12 m.

Tincture of hyoscyamus, dose, 30 m.

|                     |                         |
|---------------------|-------------------------|
| Belladonna plaster  | } used only externally. |
| Belladonna liniment |                         |

The extracts are used chiefly in pills. The tinctures are given by mouth often along with other remedies.

Atropine sulphate, dose,  $\frac{1}{120}$  gr.

Scopolamine (hyoscyne) hydrobromide, dose,  
 $\frac{1}{120}$  gr.

Homatropine hydrobromide, an alkaloid derived from atropine, used only in solutions to be dropped into the eye.

**Action and Uses.**—All of these remedies have a similar effect on certain structures in the body.



Fig. 20.—Leaves, flower, and fruit of belladonna (deadly nightshade).  
(From Wall's *Pharmacognosy*.)

1. They lessen or entirely stop the secretion of saliva, sweat, tears, milk and all other secretions except urine.
2. They relax contraction in the intestines, bladder, bronchial tubes, and almost all involuntary muscles except the walls of blood vessels.



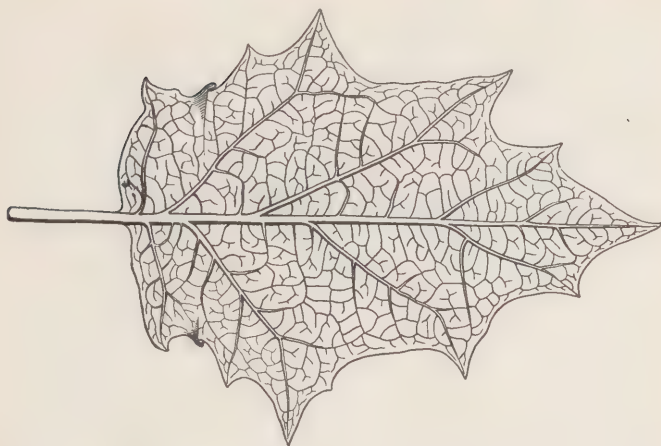


Fig. 21.—Leaf of stramonium (thorn apple or jimson weed.) (From Wall's *Pharmacognosy*.)

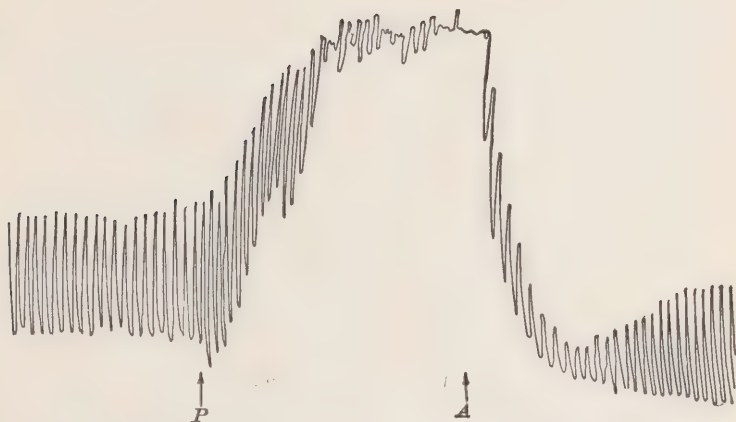


Fig. 22.—Tracing showing relaxing effect of atropine at *A* on intestinal muscle after pilocarpine at *P* had caused strong contraction. (Magnus.) (From Cushny's *Pharmacology and Therapeutics*.)



3. They increase the rate of the heartbeat but should not be considered heart stimulants.

4. They produce a number of changes in the eye. The pupil is dilated, secretion of tears is stopped, the tension inside the eyeball is increased and the ability to focus the eye for near and distant objects is impaired.

Atropine is a stimulant to the central nervous system only in large doses. The other alkaloids are more or less sedative or depressant to nerve centers.

Belladonna is used to some extent as a local remedy for the relief of pain. Stramonium leaves are often burned and the fumes inhaled for relief in asthma attacks.

Scopolamine (hyoscine) is frequently used to bring sleep in excitement with restlessness, and the sleep resulting from small doses is very natural and refreshing. It is used also with morphine before anesthesia and to relieve the pains of childbirth, to produce the so-called "twilight sleep." However, if the ordinary doses be increased, excitement instead of deeper sleep is apt to result.

**Poisoning.**—The members of this group of drugs have been responsible for a good many cases of poisoning, about 11 per cent of which proved fatal. Most of the cases have been accidental, such as giving the wrong medicine. One-twentieth of a grain of atropine mistaken for strychnine and given hypodermically is about the smallest dose known to have caused death. Hyosecyamine and scopolamine are considerably less dangerous to life than the others of this series.

**Symptoms** of atropine or belladonna poisoning come on quickly and are quite characteristic. The mouth and throat become dry and the voice husky or absent. The skin becomes dry and often a scarlet rash like scarlet

fever appears, especially on the face, neck and chest. The pulse becomes very rapid and the blood pressure is raised. The eyes are dry, brilliant, and wild looking and the pupils widely dilated. Headache comes on and often there is delirium and constant motion. When a fatal dose has been taken, the delirium gradually subsides and coma<sup>34</sup> comes on with slow respiration, feeble pulse and finally death from failure of respiration. The temperature at death is usually raised, in one case being as high as 110°. If the patient recovers, the vision may be impaired for months afterwards.

**Treatment.**—Emetics usually fail to produce results. If the poison was swallowed, wash out the stomach promptly, using some tannic acid in the solution as an antidote. If there is much excitement, a little ether or chloroform may be used or a small dose of morphine injected to quiet the patient. Should coma and depression appear, caffeine should be used as a stimulant and artificial respiration may become necessary.

**Tolerance** for this group of drugs is less in man than in most other animals. Rabbits eat freely of belladonna leaves without harm although their flesh may cause poisoning when eaten by man.

### Pilocarpine

This is an alkaloid obtained from the leaves of a South American plant called *Pilocarpus* or *Jaborandi*.

#### Preparations and Doses.—

Pilocarpine Nitrate, dose,  $\frac{1}{6}$  gr.

This is soluble in water and given mostly by hypodermic injection.

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<sup>34</sup>*Coma*, profound stupor or unconsciousness.

**Action and Uses.**—The action of pilocarpine is about opposite to that of atropine.

1. It increases the secretion of saliva, sweat, gastric juice and almost all secretions except the milk and possibly the urine.



Fig. 23.—Leaf of pilocarpus and a section magnified. (From Wall's *Pharmacognosy*.)

2. It causes contraction of smooth muscle organs such as intestines, bladder, uterus, and bronchial tubes.

3. It slows the rate of the heartbeat.

4. It contracts the pupil, increases the secretion of tears and lessens the tension inside the eyeball.

All of these effects can be prevented by the use of atropine.

Pilocarpine is used in medicine chiefly to cause free sweating, when that is desired, but it could be used also to produce the other results mentioned.

**Poisoning** with pilocarpine is not of frequent occurrence, but an overdose may cause an excessive flow of saliva, tears or sweat or fill the bronchial tubes with fluid. Sometimes there is nausea, vomiting, and fre-

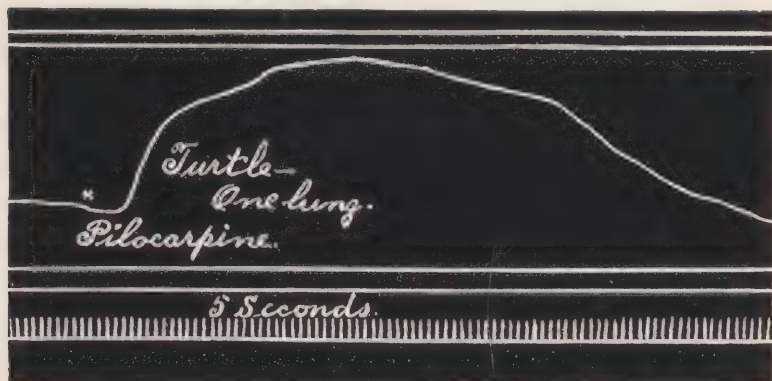


Fig. 24.—Tracing showing contraction of the lung of a turtle by pilocarpine. (From Jackson's *Experimental Pharmacology*.)

quent watery stools. The pupil is contracted and the heartbeat slow or irregular and weak.

**Treatment.**—Atropine hypodermically is the best antagonist<sup>85</sup> for pilocarpine. If the drug has been swallowed, the stomach should be washed out with a tannic acid solution.

**Arecoline**, an alkaloid obtained from the areca or betel nut, is similar to pilocarpine but more active.

<sup>85</sup>*Antagonist*, a drug that opposes the action of another drug.

Some poisonous mushrooms when eaten produce symptoms very similar to pilocarpine poisoning and the treatment would be about the same.

### Physostigmine or Eserine

Both of these names are applied to an alkaloid obtained from an African seed known as calabar bean or ordeal bean. The latter name was given it because the natives of the Calabar coast of Africa often used these beans in what is known as "trial by ordeal." A per-

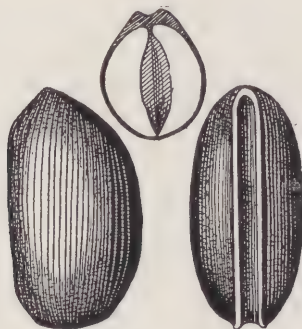


Fig. 25.—Physostigma or calabar bean. (From Wall's *Pharmacognosy*.)

son suspected of witchcraft, or other crime, was compelled to swallow some of the powdered bean. If he did not die he was declared innocent, but if he died he was guilty and there was no escape from the verdict.

#### Preparations and Doses.—

Physostigmine salicylate, dose,  $\frac{1}{60}$  gr.

Physostigmine sulphate, dose,  $\frac{1}{60}$  gr.

The sulphate is readily soluble in water, but the salicylate is not so soluble. Both are usually given by

hypodermic injection, or a drop or two of a weak solution is placed in the eye.

**Action and Uses.**—The action of physostigmine, like that of pilocarpine, is about opposite to that of atropine.

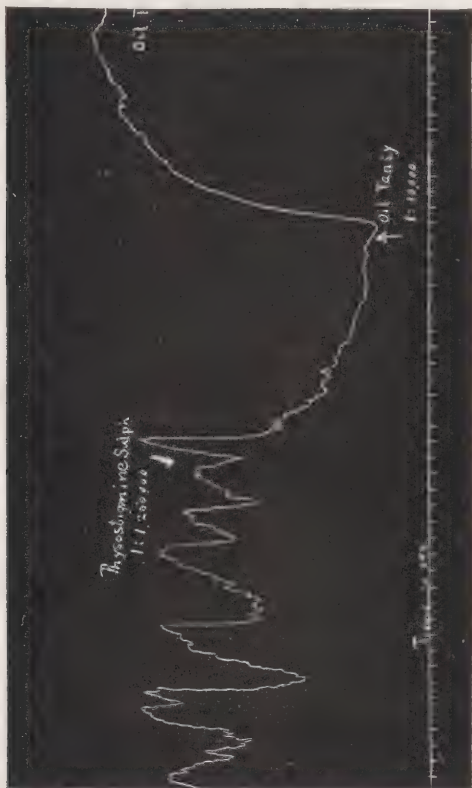


Fig. 26.—Tracing showing contraction of an intestinal segment from a dog by physostigmine (eserine), afterwards relaxed by a volatile oil.

It increases secretions, but somewhat less than pilocarpine. It contracts smooth muscle even more than pilocarpine. It slows the heart, dilates the pupil and les-



sens tension within the eyeball. Its effects are, to some extent, prevented by atropine but large amounts of it can overcome the atropine effect.

Physostigmine is used in the eye to contract the pupil and reduce tension inside the eye. It is also used to promote bowel movements, especially after abdominal operations where there is danger of paralysis of some part of the intestines.

**Poisoning** with physostigmine is uncommon, but an overdose may cause alarming symptoms. Sweating is not so great as in pilocarpine poisoning. There is muscular weakness with tremor and twitching of muscles. Vomiting, pain in the stomach, and free bowel movements usually occur. The pupil is contracted, the heart slow and weak and the breathing difficult.

**Treatment.**—Atropine in full medicinal doses will relieve most of the effects of physostigmine. If the drug has been swallowed, the stomach should be washed out with tannic acid solution.



## CHAPTER XII

### DIGITALIS AND IPECAC

#### **Digitalis Group**

This group is made up of a number of plants of very different character and found in different parts of the world. *Digitalis*, the chief one, is the leaves of the common foxglove found in our gardens and growing wild in England and in many parts of Europe. *Strophanthus* is the seed of a plant of tropical Africa, used by the natives to make an arrow poison called Kombé. *Squills* is the bulb of the sea onion which grows in the Mediterranean basin. A number of other drugs belong to this group, but they are not of enough importance for consideration here.

#### **Preparations and Doses.—**

*Digitalis* leaves (powdered), dose, 1 gr.

Tincture of *digitalis*, dose, 10 m.

Tincture of *strophanthus*, dose, 8 m.

Tincture of *squills*, dose, 15 m.

Infusion of *digitalis*, dose, 1 dr.

Syrup of *squills*, dose, 30 m.

Compound syrup of *squills*, dose, 30 m.

*Strophanthin*, dose (intravenously),  $\frac{1}{130}$  gr.

The powdered leaves are given in pills or in capsules. The fluid preparations are given by mouth and should be well diluted. *Strophanthin* should not be given by mouth, but should be well diluted with Ringer's or a similar solution, and injected very slowly into a vein.



Fig. 27.—Leaves of digitalis or foxglove. (From Wall's *Pharmacognosy*.)



Fig. 28.—Seeds of strophanthus, Kombé. (From Wall's *Pharmacognosy*.)

The dose should not be repeated inside of twenty-four hours.

**Action and Uses.**—All of the members of this series are more or less irritating when applied locally. After absorption the effects are not seen for twenty-four

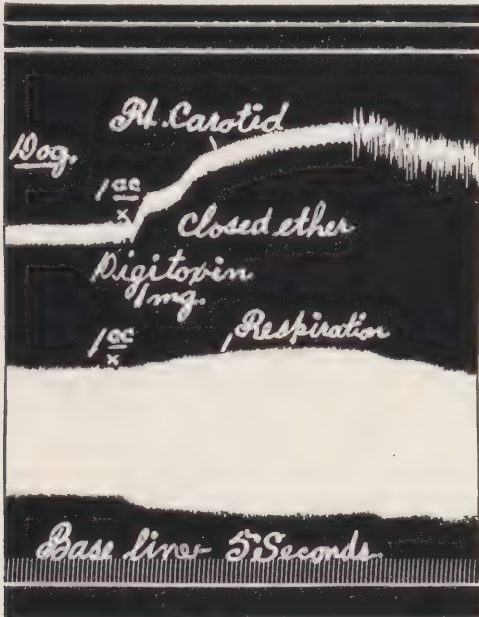


Fig. 29.—Tracing showing action of digitoxin (from digitalis) on the blood pressure (upper) and respiration (lower) of a dog. (From Jacksons *Experimental Pharmacology*.)

hours or more when given by mouth. Even when given intravenously the results are rather slow in appearing. The chief effect is on the heart and circulation. The rate of the heart beat is generally slowed and the systole<sup>36</sup> made stronger and more complete so that more

<sup>36</sup>Systole, the contracting period of the heart beat.

blood is forced into the arteries at each contraction. Even when the pulse rate is not slowed, there may be an improvement in the strength of the heart and in the general condition of the patient. As a result of the improved circulation the kidneys secrete more freely and all these drugs are considered diuretics.

Squills, given by mouth, readily causes nausea and increased bronchial mucus. The syrups of squills are used as expectorants<sup>37</sup> more than as heart tonics. The compound syrup contains some tartar emetic, which is also an expectorant, but as it is an irritant poison, this syrup should be used with care.

All forms of heart disease are not benefited by drugs of this series. In fact some heart disorders are made worse by them.

**Poisoning** with digitalis is usually the result of medicinal doses being repeated too often or continued for too long a time. Although absorbed slowly it is excreted more slowly and may accumulate in the body and finally cause poisoning. The first indication of this may be extreme slowness or irregularity of the heart, though often nausea and vomiting may be the first signs of overdose. There is usually some feeling of giddiness and severe headache. Often there is severe pain in the abdomen and diarrhea.

These cases usually recover, unless the quantity taken was excessive. Death, when it occurs, is apt to come suddenly.

**Treatment.**—If no more of the drug is given, the symptoms usually improve in a day or two. The patient should be confined to bed and kept still until decided improvement is seen. Morphine may be needed to check vomiting and relieve the pain in the abdomen. Should

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<sup>37</sup>*Expectorant*, increasing the secretion of the air passages.



Fig. 30.--Tracing showing the effect of strophanthin on the heart. White space shows where drug was injected. (Courtesy, A. N. Richards, Pharmacological Laboratory, University of Pennsylvania.)

the blood pressure become too high, which is not often the case, the nitrites would reduce it.

### Ipecac and Emetine

Ipecac is an abbreviation for ipecacuanha, but is in common use instead of the longer name. It is the root of a South American plant and contains an alkaloid *emetine*.

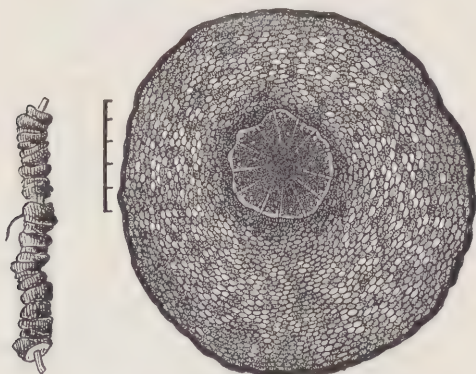


Fig. 31.—Root of ipecacuanha natural size and a cross section magnified.  
(From Wall's *Pharmacognosy*.)

### Preparations and Doses.—

Fluid extract of ipecac, emetic dose, 15 m.

Syrup of ipecac, expectorant dose, 20 m.

Dover's powder (contains opium), dose, 8 gr.

Emetine hydrochloride, dose,  $\frac{1}{3}$  gr.

The fluid preparations are given by mouth. The syrup can be used as an emetic for children in doses of a teaspoonful or more. The Dover's powder is given in capsules or tablets. Emetine is given by mouth and often injected hypodermically.



**Action and Uses.**—Both ipecac and emetine are very irritating to mucous membranes. Small amounts in the stomach cause slight nausea which increases the secretions of the mouth, throat and bronchi. This is called an expectorant action. Larger doses cause vomiting with more or less weakness and relaxation of muscles. Some sweating usually accompanies these effects, especially when Dover's powder is given.

Ipecac has long been used in the treatment of tropical or amebic<sup>38</sup> dysentery, and it is now known that the emetine in it is the chief cause of the cure. When injected beneath the skin, emetine does not cause vomiting and is more effective in dysentery than ipecac given by mouth. A new double salt, **emetine bismuth iodide**, given by mouth does not disturb the stomach and gives good results in amebic dysentery in doses of 3 to 4 grains.

**Poisoning** from ipecac by mouth is not apt to occur as the prompt vomiting will get rid of most of the drug.

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<sup>38</sup>*Amebic*, due to a microbe like an ameba, or like a white blood cell.



## CHAPTER XIII

### ANTIPYRETICS

#### Quinine

When the Spaniards conquered Peru they found the people of that country using a number of very interesting native remedies. One of the most important of these was a bark obtained from several species of trees, and used by the natives as a remedy for ague. A Spanish lady, the countess of Cinchon, was the first to in-



Fig. 32.—Bark of cinchona (calisaya). (From Wall's *Pharmacognosy*.)

troduce this bark into Spain, and it was named Cinchona after her. Our quinine is obtained from this bark. There are other alkaloids in it but they all resemble quinine.

#### Preparations and Doses.—

Tincture of cinchona, dose, 1 dr.

Compound tincture of cinchona, dose, 1 dr.

Quinine sulphate

Quinine hydrochloride

Quinine bisulphate

Quinine and urea hydrochloride.

} dose, 2 to 15 gr.

The tinctures are given by mouth but are used much less than the alkaloid. The sulphate is not very readily dissolved in water but the bisulphate and hydrochloride are freely soluble. On account of their bitter taste, these salts of quinine are usually given in capsules. The quinine and urea hydrochloride is soluble in water and is used almost entirely for local application.

**Action and Uses.**—On account of their bitter taste, both quinine and the cinchona preparations have been used extensively as bitter tonics to improve the appetite. Quinine is rather irritant to the stomach and long use may disturb digestion. It is also a fairly good antiseptic but not much used except for specific<sup>39</sup> purposes.

After absorption quinine is antipyretic, but it has little effect on normal temperature, unless given in very large doses. Its most important action is on the cause of malaria. The germ of malaria comes from the bite of a species of mosquito and lives inside the red blood cells. Quinine kills these germs and is considered a specific in malaria. It is also of value in some other diseases due to germs similar to those of malaria. Quinine is also used to prevent malaria, as well as to cure it, and many people living where this disease prevails take quinine regularly as a preventive.

Quinine increases the contractions of the uterus in labor and is often given in tardy labor. Large doses may cause labor pains and even miscarriage if given before term.

**Optochin**, a substance made from one of the cinchona alkaloids, has been used with some success in the treatment of pneumonia. In laboratory tests it is very fatal to the germs of pneumonia (pneumococcus) outside of the body. It has not been used very extensively.

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<sup>39</sup>*Specific*, a remedy that is directly curative.

Quinine and urea hydrochloride solutions are used extensively as local anesthetics. Solutions of  $\frac{1}{2}$  to 1 per cent may be injected, and much stronger solutions can be used on the surface. It takes a longer time to cause anesthesia than cocaine does, but its effects last much longer. It is not poisonous but delays healing in wounds where it is used.

**Poisoning** with quinine seldom proves fatal but many people have unpleasant effects even from small doses. There may be ringing or roaring in the ears, a feeling of fullness in the head or even headache. Very large doses may cause complete deafness for a time. Vision also is affected, especially the power to distinguish colors, and complete blindness for a time has been observed.

Treatment seldom is necessary as the symptoms usually stop when the remedy is discontinued.

### Other Antipyretics

A number of remedies obtained from coal tar have been used to reduce fever and some of these have won a prominent place in medicine. Those most frequently used are mentioned here.

#### Preparations and Doses.—

Antipyrine, dose, 5 gr.

Phenacetine, dose, 5 gr.

Acetanilide, dose, 3 gr.

Antipyrine is soluble in water; the other two are not, and are usually given by mouth in tablets or loose powders.

**Action and Uses.**—Antipyrine has some local anesthetic effects. All are more or less antiseptic.

They are used internally to *reduce temperature* or *relieve pain* and often have both of these effects. These

remedies reduce fever more promptly than quinine does, but the effect is not so lasting. Sweating usually accompanies the drop in temperature. The relief of pain is different from that caused by morphine and is not followed by drowsiness as a rule. Neuralgia, myalgia<sup>40</sup> and rheumatism are the conditions in which these remedies most readily give relief.

**Poisoning** with these drugs is nearly always the result of taking too much of one of them to relieve some pain. Many remedies on the market for headache contain one or more of these drugs, and poisoning often results from their excessive use.

The symptoms most often seen are profuse sweating, weakness, giddiness and a small rapid pulse with feeble respiration. More severe cases show fainting, collapse, a cold, clammy skin, pale, anxious face and a weak, rapid pulse. Acetanilide has been found the most dangerous of this series and phenacetine seems to be the safest.

**Treatment.**—In mild cases all that is necessary is to stop the drug and keep the patient warm and quiet in bed for a time. In severe cases, active stimulation may be needed in addition to this and a dose of atropine often gives good results.

### Salicylic Acid and Salicylates

Salicylic acid is found in a number of plants, winter-green, sweet birch and poplar, but most of it is made from substances found in coal tar. It is a solid with a harsh, sour taste and is not readily dissolved in water, but dissolves easily in alcohol or ether.

**Action and Uses.**—Salicylic acid is strongly antiseptic but is not adapted for general use in surgery as it is rather irritating to tissue and not soluble enough in

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<sup>40</sup>*Myalgia*, muscle pain or soreness.

water. It is somewhat caustic and slowly softens and dissolves horny growths on the skin, such as corns and warts. It can be applied as an ointment or plaster or dissolved in collodion. It is sometimes used in dusting powders to check excessive sweating.

Free salicylic acid is not much used internally but its compounds are extensively used.

### **Preparations and Doses.—**

Sodium salicylate, dose, 15 gr.

Methyl salicylate (oil of wintergreen), dose,  
12 m.

Aspirin (acetylsalicylic acid), dose, 10 gr.

Salol (phenyl salicylate), dose, 5 gr.

Any of these can be given in capsules and all but the oil of wintergreen are used as 5 gr. tablets. Only the sodium salicylate is readily dissolved in water. It can be given by mouth in solution and is sometimes given intravenously with a hypodermic needle.

These remedies are all more or less antipyretic and analgesic,<sup>41</sup> that is, they reduce fever and relieve pain. They are used mostly in the treatment of acute rheumatic fever, and by some are considered specific in that disease. If they do not cure, they certainly afford great relief of all the distressing symptoms.

Aspirin is used extensively for the relief of headaches, neuralgias, and muscle pains.

Salol is most frequently used as an intestinal and urinary antiseptic. Any of them can be used to reduce fever in conditions other than rheumatism. All have antiseptic properties.

**Poisoning.**—Sometimes skin eruptions are seen after salicylates even when no other symptoms are present.

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<sup>41</sup>*Analgesic*, a remedy that relieves pain.

Long continued use of even moderate doses will usually disturb digestion. The frequent appearance of albumin and casts in the urine of such patients shows that salicylates irritate the kidneys.

Fatal poisoning with salicylates is not very common, but excessive doses often cause unpleasant and even alarming symptoms. Certain persons are very sensitive to these remedies, and even small doses may produce disagreeable effects in them. Some of the effects resemble those due to quinine. Heaviness and fullness in the head, roaring sounds in the ears, and excessive sweating are the effects most frequently observed. In more serious cases there may be impairment of sight and hearing, dyspnea and collapse with a slow, weak pulse, subnormal temperature and even unconsciousness.

**Treatment of Poisoning.**—In mild cases all that is necessary is to stop giving salicylates in any form. In serious cases the stomach should be washed out and the patient kept warm in bed. Caffeine (hot coffee) or strychnine should be given as a stimulant or a little atropine if sweating is excessive.



## CHAPTER XIV

### DRUGS ACTING ON BLOOD VESSELS AND UTERUS

#### **Adrenalin (Epinephrin)**

In all the higher orders of animals, there is a small gland just above the kidney which contains a very active substance. This has been named "epinephrin" by the man who first obtained it in a pure form, but the trade name most commonly used is adrenalin. It is obtained from the glands of the animals used in meat industries.

**Preparations and Doses.**—A water solution of adrenalin chloride 1:1000 is the form in which it is most frequently sold. The dose of this for intravenous use is small—2 or 3 minims. By mouth or hypodermically much more can safely be given, as it is only slightly absorbed and is rapidly destroyed by the tissues.

**Action and Uses.**—The most important action of adrenalin is its powerful constriction of blood vessels. It has no effect on the unbroken skin, but, when applied to a bleeding surface, it contracts the bleeding vessels and promptly stops bleeding unless a large vessel has been cut. If applied to a membrane such as the eye or nose, it contracts blood vessels to such an extent as to stop secretion and make the surface pale and bloodless. It is the best remedy known for checking hemorrhage when it can be applied to the bleeding area, but its action does not last long.



It is also used along with cocaine, or other local anesthetic, in minor surgery, to prevent hemorrhage when tissues are cut. It has little or no effect on vessels of the lung or brain.

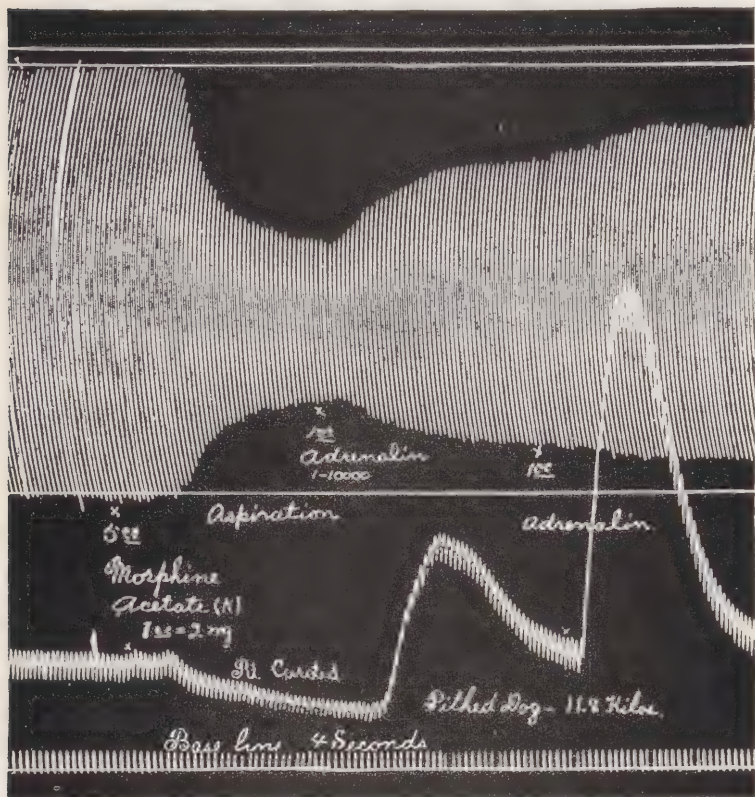


Fig. 33.—Tracing of the action of adrenalin on the blood pressure (lower) and bronchial tubes (upper), following the giving of morphine. (From Jackson's *Experimental Pharmacology*.)

When adrenalin is injected into a vein, it causes a rapid contraction of blood vessels and rise in blood pressure. The heartbeat usually is strengthened

though the rate of the pulse may be increased or lessened. It causes contraction of the uterus, especially in pregnancy, but relaxes certain smooth muscles such



Fig. 34.—Tracing showing the action of adrenalin on the heart. White space shows where drug was injected. (Courtesy, A. N. Richards, Pharmacological Laboratory, University of Pennsylvania.)

as those of the intestines and bronchial tubes, especially if they are contracted, as the latter are in asthma.

Adrenalin is sometimes used for its action on the circulation in emergencies such as heart failure or shock, but it must be given intravenously and cautiously, as an overdose might cause death from high blood pressure, or by bringing on fibrillation of the heart. At best its stimulant action is brief, lasting only about five minutes.

### Ergot

This is a fungus which grows on rye and some other grain and is commonly called smut. It was recognized as a poisonous impurity in rye bread long before it



Fig. 35.—Ergot of rye. (From Wall's *Pharmacognosy*.)

was used in medicine. It contains an active alkaloid, ergotoxin and several other active substances one of which, tyramine, has been used to some extent as a remedy.

### Preparations and Doses.—

Fluid extract of ergot, dose, 30 m.

This preparation is usually given by mouth and is not suitable for hypodermic use, but a number of preparations are obtainable that can be given in that way.

**Action and Uses.**—Ergot has no local action. After absorption it causes contraction of the smooth muscle of the uterus and blood vessels. The constriction of

vessels comes on much more slowly than after adrenalin, lasts longer, and does not cause so great a rise in blood pressure. The contraction of the uterus is the most important effect of ergot. The contractions are usually followed by relaxation after a few minutes, and continue with alternate contraction and relaxation as in normal labor, but sometimes the contractions become continuous and tend to remain so.

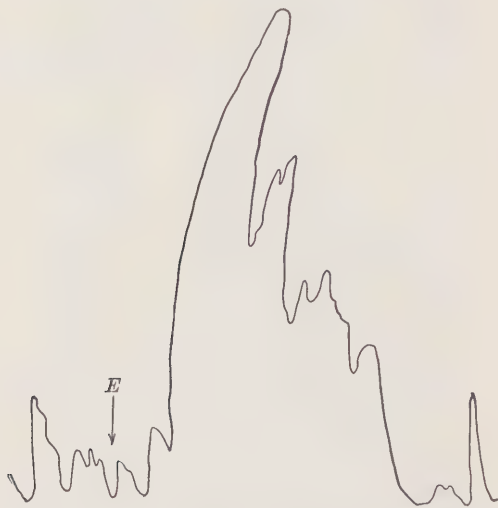


Fig. 36.—Tracing showing contraction of the uterus under ergot injected at *E*. (From Cushny's *Pharmacology and Therapeutics*.)

Ergot is used to prevent uterine bleeding, especially after childbirth. It is of value in hemorrhage from the uterus at other times, but it is of doubtful value in bleeding from other organs. It can be used to increase blood pressure, but is not often so used.

**Tyramine** stimulates the respiration and circulation. It has been recommended for use with morphine in labor or anesthesia to counteract the depression of respi-

ration caused by morphine. It would also be of value in the treatment of morphine poisoning.

**Poisoning** with ergot might result from long use of large medicinal doses, but most cases have resulted from eating rye bread in which this fungus was present. This slow form of poisoning, called ergotism, is seldom seen now, as improved machinery is used to clean the grain before grinding it.

The most striking symptom of ergotism is a dry, painless gangrene of some remote portion of the body such as fingers and toes. The part affected becomes cold, numb, dark in color. It dries up, and drops off without pain or bleeding. These changes are due to the contraction of blood vessels shutting off the blood supply of those parts.

### **Pituitrin, Pituitary Extract**

Hidden beneath the brain in a depression in the base of the skull is a small gland which, in man, weighs only from 5 to 10 grains. This little gland, called the pituitary, furnishes the body with a very important secretion, and solutions made from it are used in medicine.

**Preparations and Doses.**—A watery solution made from the posterior portion of the gland is put up in ampules containing about 15 minims each. This is called "pituitrin," and the amount in an ampule is considered a hypodermic dose. It has no effect when given by mouth.

**Action and Uses.**—Pituitrin stimulates smooth muscle and causes it to contract. Its effect on blood vessels is similar to that of adrenalin, but the constriction comes on more slowly, lasts longer, and the blood pressure is not increased as much. It causes contraction of the intestines and increased movement of their contents. It

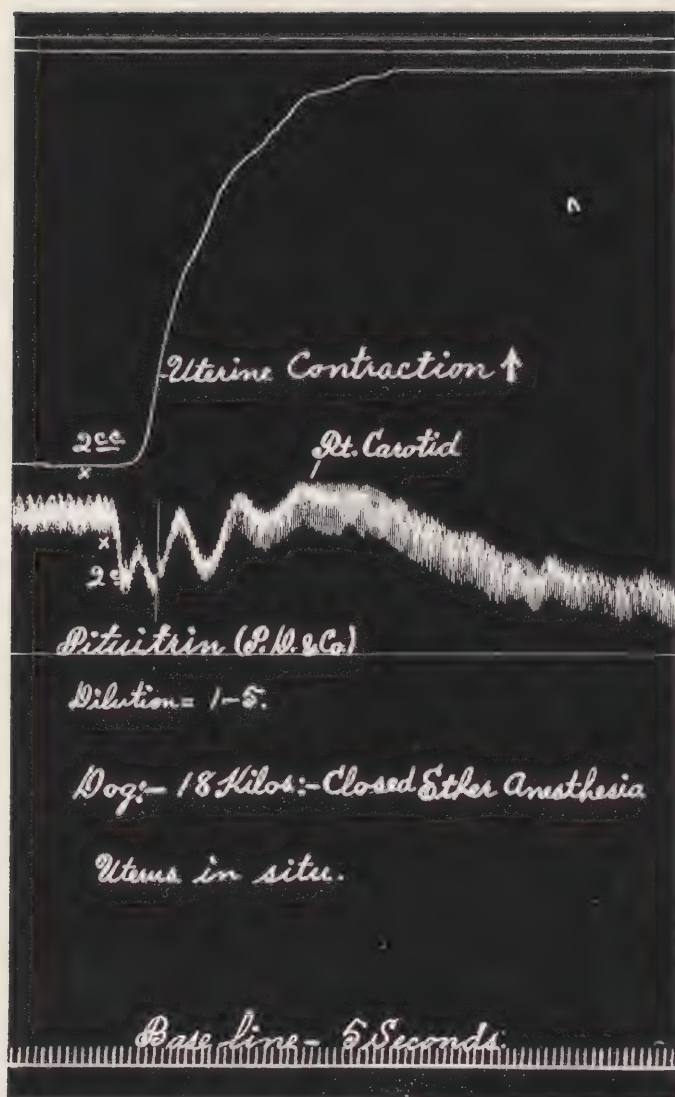


Fig. 37.—Tracing showing contraction of the uterus (upper) and blood pressure (lower) under pituitrin injected at X. (From Jackson's *Experimental Pharmacology*.)



causes the uterus to contract also and usually its contents are expelled. An increased flow of urine usually follows its use, and the flow of milk is increased at first, but the increase can not be kept up by repeated doses.

Pituitrin is used chiefly for its action on the uterus either to aid in childbirth or to check bleeding after delivery of the child. It has also been found of value in failure of the intestinal movements after operation.

**Hydrastinine**, an alkaloid derived from hydrastis or golden seal, has an action on the uterus similar to that of pituitrin, but less powerful. It is sometimes given in  $\frac{1}{2}$  grain doses to check uterine hemorrhage.

**Stypticin**, made from an opium alkaloid, is similar to hydrastinine, but less active and little used.

### The Nitrites

A number of substances make up this group, and, although they differ in composition and appearance, they all produce similar results.

#### Preparations and Doses.—

Amyl nitrite, dose, 3 m (inhaled).

Spirits of nitroglycerine, dose, 1 m.

Sodium nitrite, dose, 1 gr.

Sweet spirits of nitre, dose, 30 m.

(spirits of nitrous ether)

Amyl nitrite is a very volatile, pungent liquid and is usually dispensed in "pearls," or small glass capsules, each of which contains a dose. The pearl can be broken in a handkerchief and the remedy inhaled.

Nitroglycerine comes in tablets of  $\frac{1}{100}$  gr. each, as well as in a solution. The tablets are soluble in water and can be given by mouth or hypodermically. Sodium



nitrite and sweet spirits of nitre are given by mouth, dissolved in water.

**Action and Uses.**—The chief action of these remedies is to dilate blood vessels and lower blood pressure.

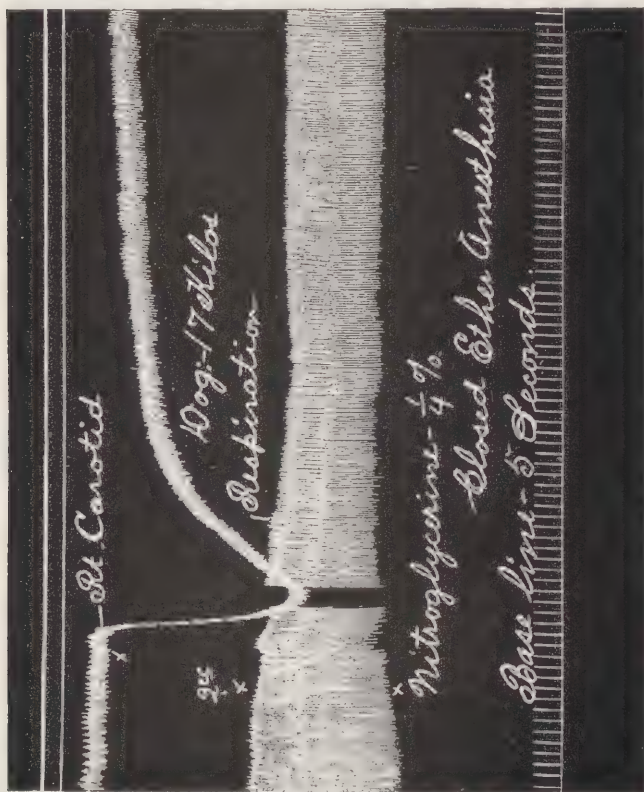


Fig. 38.—Tracing showing action of nitroglycerine on blood pressure (upper) and respiration (lower) of a dog. (From Jackson's *Experimental Pharmacology*.)

Amyl nitrite, given by inhalation, acts very quickly, but the action is brief. Nitroglycerine is a little slower and lasts a little longer. Sodium nitrite, which is taken

into the stomach, is the slowest, but its action is the most prolonged.

Amyl nitrite causes flushing of the face, throbbing in the neck and head, increased rate of the pulse, and a feeling of fullness in the head, often with some headache and mental confusion. Nitroglycerine causes similar results and often very distressing headache.

The muscles of the bronchial tubes are relaxed by the nitrites, and amyl nitrite or some other of this group is used to give temporary relief in asthma. When salt-peter is burned some nitrite is given off in the fumes and this relieves asthma in the same way. As the vessels of the lungs are only slightly relaxed, if at all, by amyl nitrite, it has been found useful to check bleeding from the lungs.

**Poisoning** with nitrites is not very important. While very alarming symptoms may result from overdose, very few fatal results have been recorded. Persons handling nitroglycerine or dynamite frequently suffer from severe headaches, but a change of occupation usually brings prompt relief.

## CHAPTER XV

### LOCAL ANESTHETICS

#### Cocaine

Although this alkaloid is rather new as a remedy, the leaves of the coca tree from which it is obtained have long been used by the natives of Peru and Bolivia as a mild excitant and stimulant. Over \$10,000,000 worth of coca leaves are exported annually from Peru alone.

The form in which cocaine is used in medicine is chiefly as the salt, cocaine hydrochloride, which dis-

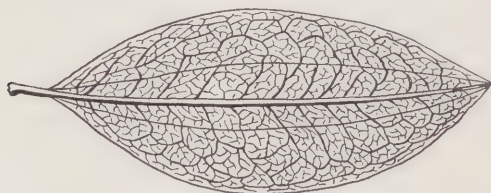


Fig. 39.—Leaf of coca, the source of cocaine. (From Wall's *Pharmacognosy*.)

solves readily in water but does not keep well in water solution. The strength of solutions in common use is 4 per cent or less, according to the location to which it is applied and the quantity used. Occasionally much stronger solutions are used.

**Action and Uses.**—Cocaine is a local anesthetic, that is, it suppresses the sensation of pain in parts to which it is applied. It does not abolish all sensation, as heat and cold can still be felt. It has little effect on the

unbroken skin, as it does not readily penetrate to the nerve ends on which it acts. Cocaine also contracts blood vessels locally and thus tends to lessen hemorrhage. The effects last only about 20 to 30 minutes.

Cocaine is often applied to the eye, and it dilates the pupil and prevents reflex winking as well as abolishing pain. Applied in the nose, it shrinks the mucous membrane and abolishes the sense of smell as well as pain. Its frequent use in minor surgical operations renders the use of a general anesthetic unnecessary.

When cocaine is injected into or near a nerve, it prevents the sensation of pain in the parts supplied by that nerve. This is called *nerve block*. When injected into the spinal canal posterior to the cord it has a similar effect, and the lower limbs and lower part of the body are rendered insensible to pain, but the power of motion remains more or less. This is spoken of as *spinal anesthesia* and surgical operations have been performed under this form of anesthesia.

### Substitutes for Cocaine

On account of rather frequent poisoning resulting from the use of cocaine, a number of other drugs have been introduced to take its place. Most of these are less poisonous, and at the same time, almost, if not quite, as effective as cocaine itself, but they do not constrict blood vessels.

**Eucaine** (beta-eucaine) is not half as poisonous as cocaine and is just as effective as an anesthetic.

**Stovaine** is much less dangerous than cocaine and fully equal to it as an anesthetic.

**Novocaine** is both less harmful and less active than cocaine, but is entirely nonirritating.

**Quinine and urea hydrochloride** is also used as a local anesthetic. It is practically nonpoisonous, and its effects last a long time.

**Epsom salts** (magnesium sulphate) in strong solutions has some pain-relieving effect when locally applied. Spinal anesthesia also can be produced by proper amounts of this remedy, and even general anesthesia can be developed by intravenous injection.

**Poisoning.**—Cocaine is quite liable to cause alarming symptoms even from local application, and such results often occur rather unexpectedly and from small amounts of the drug. In most cases there is some excitement; the patient is restless and talkative, though sometimes anxious and alarmed. Rather frequently, however, the first symptoms observed are dullness and quietness without drowsiness. In any case the pulse is fast and the breathing deep and rapid. The pupils are dilated, the mouth and throat dry, and most patients complain of headache. In more serious cases the pulse and respiration become extremely rapid, and fainting and collapse occur. Occasionally spasms or convulsions are seen. Death finally comes from failure of respiration.

**Treatment.**—In mild cases all that is necessary is to stop the use of cocaine and have the patient lie down and remain quiet for several hours. In the serious cases the physician will treat the symptoms as they appear. If the cocaine has been swallowed, the stomach should be washed out and tannic acid solution (strong tea) given through the tube.

**Cocaine Habit.**—This habit is acquired either from frequent medicinal use or deliberately for the effects the drug produces. One user often induces others to acquire the habit, and habitués generally assist each other in obtaining the illicit drug. The tolerance for co-

caine is considerable, and the strength of the habit is such that it is doubtful whether it is ever abandoned voluntarily. The earliest effects may be digestive disturbances, loss of appetite and of weight, but the nervous system suffers most, and gradual degeneration of mind and morals, as in opium habit, usually results. Sleeplessness, tremors, spasms, insanity, and delirium are some of the consequences of long-continued use.

Treatment, including restraint, can be carried out only in a properly equipped institution.

### **Aconite and Veratrum**

Neither of these drugs is of much importance as a remedy. Aconite is the root of monkshood. Veratrum is the root of green hellebore. Each contains a powerful alkaloid, aconitine in aconite root, veratrine and other alkaloids in the veratrum.

#### **Preparations and Doses.—**

Tincture of aconite, dose, 8 m.

Tincture of veratrum, dose, 8 m.

These are usually given in water by mouth. The alkaloids are seldom used.

**Action and Uses.**—When applied to a mucous membrane, as in the mouth, they cause a peculiar prickling and tingling sensation followed by numbness. After absorption they reduce the temperature somewhat, often cause sweating, and in large doses may reduce the rate of the heart beat.

**Poisoning** is readily caused by these drugs, especially by aconite. Aconitine is one of the most poisonous substances known. The symptoms are prickling and tingling in the lips, mouth, and throat, later on all over the skin. There is profuse salivation, nausea and vomiting,



profuse sweating, great weakness and a slow feeble pulse. With veratrum there is also violent purging and severe pain in the abdomen. In fatal cases convulsions often occur.

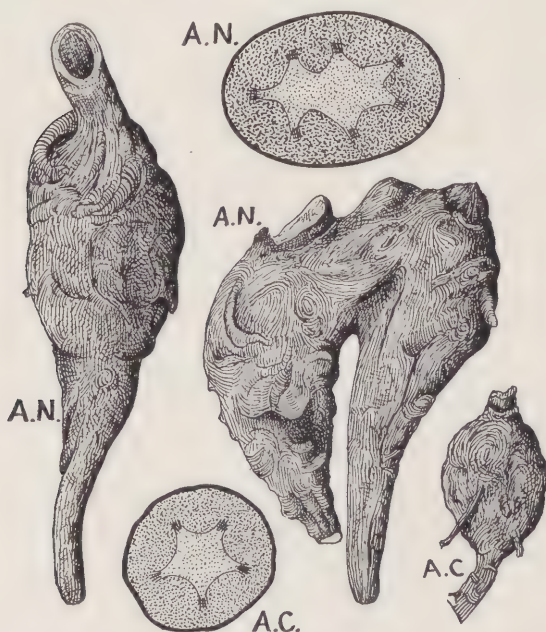


Fig. 40.—Aconite root, various forms and cross sections. (From Wall's *Pharmacognosy*.)

**Treatment.**—Wash out the stomach with a tannic acid solution (tea). Keep the patient warm, quiet and still. Give atropine hypodermically in full doses.

## CHAPTER XVI

### ANTITOXINS AND VACCINES

#### Antitoxins

When the germs of certain infectious diseases live and grow in the body of man, or some animal, they form poisons which cause many of the symptoms of the disease. These poisons are called toxins, and the germs of each disease produce a different toxin.

As soon as the body cells find a toxin present, they begin to make something to neutralize it to make it harmless. The substance formed is called an antitoxin, and each disease that produces a toxin requires a different antitoxin. If the patient with such a disease can make the antitoxin faster than the germs can make the toxin he will get well; if he can not, he will die unless he gets help. If we now inject into this patient some blood serum from a horse that has had the same toxin in his body for a long time and has made a lot of the antitoxin for himself, it will increase the patient's supply, and enable him to overcome the disease. This is the way **diphtheria antitoxin** helps a person that has diphtheria.

Horses are used for making antitoxins because they yield so much blood and are easily handled. The horse is injected with the special toxin a number of times and in increasing doses until its blood is rich in antitoxin. Some of the blood is withdrawn aseptically from its veins, the corpuscles are removed, and the clear serum put into glass ampules, each containing a definite amount of antitoxin. This is the form in which the antitoxin is kept until needed.

*The tetanus antitoxin* is not of very great value when the disease has developed. Its value is as a preventive of tetanus in persons who have received injuries that are liable to cause this disease. It should always be used promptly.

### **Bactericidal Serums**

Many disease germs do not form soluble toxins and the body cells do not form antitoxins, but the presence of the germs themselves causes the body cells to form a substance that will kill them. It will not kill any other kind of germs. Horses are used to make a lot of this substance in their blood serum, which is called a bactericidal serum, as it kills bacteria instead of neutralizing their toxins.

*Antimeningitis serum* is of this character. It may be injected hypodermically but the best results are obtained when the serum is injected into the spinal canal where the disease germs are located.

*Antistreptococcus serum* is another of this class. It is used in many diseases due to streptococcus infection.

Many other serums are used more or less, such as antipneumococcus serum, and antigonococcus serum, but their value is not well recognized and they are not often used.

### **Bacterial Vaccines**

If the killed germs of a disease are injected in small amounts into man or some animal, they will not cause disease, but they will cause the cells of the body to protect themselves against the living germs of that particular disease. Such dead germs, or products obtained from them, are called bacterial vaccines. They do not protect the body against any germs except the par-

tiular one used in making the vaccine. Such vaccines do not cause the body cells to make an antitoxin, but to prepare themselves in various ways to resist the living germs should they be already in the body or gain an entrance later.

Bacterial vaccines may be of value either in preventing the development of a disease or in curing it when already present in a chronic form. *Typhoid fever* is well prevented by using bacterial vaccines, but when the disease has developed, they do not do much good. On the other hand *tuberculin*, a form of bacterial vaccine, has given good results in the treatment of various forms of tuberculosis, especially in early stages.

A bacterial vaccine can be made for use in any disease the germ of which can be obtained and cultivated outside the body. Many are being used with benefit to the patient, others without much effect. They can not all be mentioned here.

**Poisoning** with animal serum in small amounts is seldom serious at the time of the first injection. **Serum sickness**, with various skin eruptions and itching, fever and muscle pains, may result, but does little harm. However, if the same serum, even in smaller amounts, is again injected after ten to fourteen days, it may cause very alarming symptoms or even a fatal result. A great sensitiveness to the protein of the serum used has been developed by the individual and the later injection may cause alarming dyspnea, collapse, and even death. This condition of increased sensitiveness to a protein is known as *anaphylaxis* and may last for a long time, even throughout life.

## CHAPTER XVII

### THE ARSENIC GROUP

#### Arsenic

What is commonly called arsenic is in reality arsenic trioxide. It is a white solid or powder with a faint sweetish taste and no odor.

#### Preparations and Doses.—

Arsenic trioxide (white arsenic), dose,  
 $\frac{1}{30}$  gr.

Fowler's solution (a 1 per cent solution),  
dose, 3 m.

Arsenic trioxide is slowly soluble in water, but is usually given in pills or tablets. Fowler's solution, which is the form most frequently used, is usually given in a little water, in gradually increasing doses.

**Action and Uses.**—Arsenic has been used locally to destroy malignant growths of the skin such as cancer and lupus, but newer methods of treatment have largely done away with cancer pastes which usually contained arsenic. It is still used in dentistry to destroy the pulp in decayed teeth.

Arsenic is called an alterative,<sup>42</sup> and is used in many chronic diseases without knowing just how it acts. Given internally, it often improves appetite and digestion, and increases weight by improving nutrition and lessening tissue waste. Arsenic is often of value when given for a long time in neuralgia and old cases of

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<sup>42</sup>*Alterative*, a remedy that has a favorable influence on nutrition.

chorea. It has given good results, when taken internally, in dry, scaly skin diseases and in some forms of chronic anemia and leucemia.<sup>43</sup>

**Poisoning.**—In the Middle Ages, arsenic was used as a poison more than any other drug, largely because of its absence of taste. The smallest dose likely to prove fatal in an adult is about  $1\frac{1}{2}$  grs. The symptoms do not come on for half an hour or more after the poison has been swallowed. The earliest symptoms are a feeling of tightness in the throat, some difficulty in swallowing and an uneasy feeling in the stomach. Soon nausea, vomiting and diarrhea come on with pain, griping and frequent watery passages. Blood may appear in the vomited matter and stools. There is giddiness, weakness, cramps in the leg muscles, headache and severe pain in the abdomen. Later the pulse and respiration become weak, the skin is cold and moist, the face pale and anxious in expression. This condition of collapse may pass into coma and death with, or without, convulsions. Death may come within twenty-four hours, but often is delayed two or three days, and finally results from exhaustion due to continued vomiting and purging.

Should the patient recover, he is likely to suffer for a time from chronic arsenic poisoning, which will not be discussed here.

**Treatment.**—Wash out the stomach repeatedly through a stomach tube. This should be done even though vomiting has begun, as the washing will remove the poison more completely than vomiting can. The antidote usually advised, fresh hydrate of iron, may be used, but it is of doubtful value. Morphine, in small amounts, is necessary to relieve pain and vomiting. When symptoms

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<sup>43</sup>*Leucemia*, a chronic disease with increased white cells and diminished red cells in the blood.



of collapse appear, stimulants and warmth should be used. The hypodermic or intravenous injection of saline solutions is of much value in replacing some of the water lost by vomiting and continued purging.

**Tolerance.**—The continued use of increasing doses of arsenic will develop a considerable tolerance. In some mountain regions of Europe, many of the people take quite large amounts, as they believe it increases their endurance in mountain climbing. In this country it is sometimes taken by young women to improve the form and complexion. This use does not seem to do any great harm.

### Organic Compounds of Arsenic

Arsenic has often been used with success in the treatment of certain infectious diseases such as malaria and syphilis. In recent years a number of organic compounds of arsenic have been extensively used because they are less poisonous to the patient than ordinary arsenic and therefore can be used in doses large enough to kill the germs of disease.

#### Preparations and Doses.—

Salvarsan (arsenobenzol, 606), dose, 8 gr.

Neosalvarsan, dose, 12 gr.

Salvarsan comes in air-tight tubes, and they should not be opened until just before using. Both of these remedies are generally given intravenously and should be well diluted with sterile salt solution and injected *very slowly*. If necessary to repeat the dose, a week or two should elapse before another injection is given.

**Action and Uses.**—These, and similar remedies, have been used chiefly in the treatment of syphilis. As they

kill the germs which cause the disease, they are effective at any stage of the infection. In a test tube it takes a solution of salvarsan about 1:1000 to kill the germs of syphilis, but in contact with living tissue it becomes many times more active, and one dose will sometimes kill all the syphilis organisms in the body of a patient.

Salvarsan and neosalvarsan have given good results in several other diseases, such as Vincent's angina<sup>44</sup> and malaria, due to germs similar in nature to those of syphilis. In ordinary cases of malaria, however, they are not as effective as quinine.

**Poisoning.**—Hypodermic or intramuscular injection of salvarsan usually causes severe pain, swelling, and hardening of tissue. This method of giving is seldom used now.

When properly prepared and injected slowly into a vein, as a rule, no unpleasant results are experienced. Sometimes headache, giddiness, nausea and fever are observed. Less often, vomiting, diarrhea, jaundice, dyspnea and profuse sweating occur. In a few cases, collapse, coma and death have followed an injection of one of these remedies.

A number of compounds similar to salvarsan, such as *arsphenamine* and *diarsenol*, have more recently been introduced for the same purposes. Although all are not as satisfactory as the original products, some have been used quite successfully.

### Antimony

Only one salt of antimony is used in medicine and at present that one is not very often used.

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<sup>44</sup>*Vincent's angina*, a severe form of infectious sore throat.

**Preparations and Doses.—**

Tartar emetic, emetic dose,  $\frac{1}{2}$  gr.

Tartar emetic, expectorant dose,  $\frac{1}{20}$  gr.

Compound syrup of squills, dose, 30 m.

Tartar emetic is a double salt, antimony and potassium tartrate. It is a white powder, soluble in water, with a taste sweetish at first but later becoming harsh and metallic.

**Action and Uses.**—Tartar emetic applied to the skin will cause small pustules to form, but it is now rarely used in this way. By mouth it is emetic in large doses and expectorant in smaller amounts. At present it is seldom used as an emetic. The compound syrup of squills is the form in which it is most frequently used as an expectorant in dry, irritating coughs.

**Poisoning** with tartar emetic was rather common in the early days of medical science. The symptoms are very similar to those of arsenic poisoning, but vomiting comes on more quickly and is more severe, while the diarrhea is less severe and may be absent.

**Treatment.**—Tannic acid (strong tea) should be used as an antidote. Otherwise treat about the same as arsenic poisoning.

## Phosphorus

Phosphorus is an element which makes up a considerable portion of bone tissue. It is a solid, white or yellow in color, with an odor like garlic. It gives off light in the dark and catches fire when exposed to the air.

**Action and Uses.**—Phosphorus stimulates the growth of hard bone and may be used in those diseases in which bone development is slow. A phosphorus pill containing  $\frac{1}{100}$  gr. of the drug can be used.

**Poisoning.**—The use of phosphorus in making matches and in pastes to kill vermin has often led to poisoning, but the matches now in use in this country are not very dangerous.

The symptoms do not appear for several hours, but the breath may have an odor like garlic. Pain in the abdomen, nausea and vomiting come on and later there may be diarrhea. The vomited matter and stools have the odor of garlic. Collapse and death may occur at this time, but more often there is improvement in a day or two, and later on jaundice, hemorrhages, and other symptoms of damage to the liver, spleen and other internal organs appear, and death may result days or weeks afterwards.

**Treatment.**—Wash out the stomach even though the patient has vomited. Hydrogen peroxide or potassium permanganate will oxidize some of the phosphorus. Copper sulphate solution, if given early, will cause vomiting and will also make it less soluble. A good saline purge is of value. Demulcents should be given, but fats and oils are to be avoided.

## CHAPTER XVIII

### THE HEAVY METALS

Salts of the heavy metals are mostly used externally. Mercury and iron are the only metals having important internal uses. Many of the salts of metals are actively *antiseptic*, all are more or less *astringent* and *irritant* and a few are *corrosive* when applied pure or in strong solutions. The salts of the heavy metals with organic acids, such as citric and tartaric, are much less irritating and astringent than corresponding salts of the mineral acids such as nitric or sulphuric. Silver nitrate is the salt most frequently used as a caustic. Lead acetate, alum and the chloride or sulphate of iron are the most frequently used astringents. Bichloride of mercury and the silver combinations are most often used as antiseptics. The soluble salts of mercury are the most irritating of this series.

The heavy metals are absorbed slowly from the alimentary canal. Mercury is the most rapidly absorbed of these, but it is absorbed much more slowly than most organic remedies. Some of the metals do not seem to be absorbed at all. When they are absorbed, they are excreted very slowly and in some cases remain in the body for months, or even years, and in one case, that of silver, the metal remains permanently and can not be removed in life.

#### Mercury

Mercury itself, as well as some of its salts, has long been used as a medicinal agent. It forms two kinds of

salts with acids. The kind called *mercuric* are mostly soluble in water, while those called *mercurous* are insoluble. Corrosive sublimate and calomel are the best known examples of these two classes.

### **Preparations and Doses.—**

Bichloride of mercury (corrosive sublimate, mercuric chloride), dose,  $\frac{1}{30}$  gr.

Poison tablets of bichloride of mercury,  $7\frac{1}{2}$  gr. each.

Calomel (mild chloride of mercury, mercurous chloride), dose,  $\frac{1}{4}$  to 2 gr.

The bichloride is soluble in about 16 parts of water, and should be well diluted if given by mouth. Calomel is insoluble in water and is usually given in tablets. It has no taste. The smaller dose mentioned should be repeated at short intervals until one or two grains have been taken. The dose of 2 gr. should not be repeated for some time. The poison tablets are for making antiseptic solutions and are never to be given internally.

### **Preparations of Metallic Mercury (for internal use).—**

Gray powder (mercury with chalk), dose, 4 gr.

Blue mass (mass of mercury), dose, 4 gr.

Blue pill (blue mass made into pills).

Gray powder is tasteless and insoluble in water and is usually given in powders. The blue mass is given by mouth in the form of blue pill.

### **Mercury Ointments (for external use)**

Blue ointment (mercury ointment) 50 per cent.

Blue ointment dilute, 33 per cent.

Yellow oxide of mercury ointment.

Red oxide of mercury ointment.



Ammoniated mercury ointment (ointment of white precipitate).

Nitrate of mercury ointment (citrine ointment).

The blue ointments are often rubbed into the skin to have the mercury absorbed. The yellow oxide ointment is frequently applied to the eyelids. All are applied externally, mostly as antiseptics.

**Action and Uses.**—Mercury is mostly used as an antiseptic or disinfectant whether applied externally or given internally. The chief internal use is in the treatment of syphilis. Its use in this disease goes back to the Middle Ages. It has been given by mouth, rubbed into the skin, injected hypodermically and vaporized and absorbed by the skin. Hypodermic or intramuscular injections are very painful. Before the use of the salvarsan series of arsenic compounds, mercury was the chief remedy for syphilis. It is still much used in that disease, often along with the arsenic compounds. Its curative action is slower than that of arsenic, and, to kill all germs in the body, it should be given for a long time.

The mercury ointments are largely used externally in the treatment of parasitic<sup>45</sup> skin diseases and infections of the skin. The blue ointments especially must not be used too freely as the absorption of mercury by the skin may cause chronic poisoning. The ointment of ammoniated mercury is perhaps the best for local action on the skin.

Some of the insoluble mercury preparations are used as mild purgatives. Calomel and gray powder are the ones most frequently used, though blue pill has been

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<sup>45</sup>*Parasitic*, caused by some animal living upon, or within, the body of another.

much used in the past. In proper doses the purgative action of these remedies is mild and rather slow (six to eight hours), but sometimes griping and some nausea result. Calomel is said to be an intestinal antiseptic and this is to some extent true, but its chief value is in removing the infected material from the bowel, thus lessening the amount of infection. Calomel has no action of any kind on the liver. Its benefit in biliousness is due to its emptying the bowel of the material causing the biliousness.

**Poisoning.**—Two forms of mercury poisoning must be considered as both are quite often seen. *Acute* poisoning is due to an overdose of some soluble salt of mercury, usually corrosive sublimate. Very often an antiseptic tablet is swallowed by mistake or with the intention of committing suicide.

The symptoms come on at once with a harsh metallic taste and burning pain in the mouth, throat, and stomach. Nausea and vomiting soon follow, and a little later on violent purging sets in. The stools are watery and may be bloody and contain shreds of mucous membrane. Depression and collapse soon appear with weak pulse, feeble respiration, and low blood pressure. Death may occur within several hours, though more often it is delayed for two or three days. In the prolonged cases acute nephritis frequently develops, with suppression of urine, uremic convulsions, coma and death as a probable result. The milder the gastrointestinal symptoms, the greater the danger of acute nephritis. Absorption of mercury from bichloride solutions used in wounds or body cavities, as in the uterus, may cause acute poisoning without nausea and vomiting, but is more likely to cause the chronic form of poisoning described below.

**Treatment.**—Wash out the stomach by means of a tube and give freely demulcents such as white of eggs, milk, or ice cream. An antidote composed of sodium hypophosphite and sodium acetate has been advised. The pain will require morphine and the collapse calls for stimulants and warmth. The intravenous injection of an alkaline solution, such as Fisher's,<sup>46</sup> will lessen the damage to the kidneys in the prolonged cases with symptoms of nephritis.

**Chronic** mercury poisoning is also known as *salivation*, *ptyalism* and *mercurialism*. This form of poisoning develops slowly, and may result from the use of mercury in any form and used in any manner. Calomel has probably caused it more often than any other form of mercury. It is due to the mercury being absorbed faster than it is excreted, and not to the use of salt or vinegar or any special article of diet.

The first symptoms are a metallic taste in the mouth, soreness of the tongue and gums and a profuse flow of saliva. The breath has an offensive odor and the tongue is coated and swollen. Disturbances of the stomach with lack of appetite, nausea, and occasional vomiting are very common. In the more severe cases ulcers form on the tongue and inside of the cheek; the teeth may become loose or even fall out, and necrosis of soft tissue and bone may result.

**Treatment.**—Careful dosage, and cleanliness of the mouth, throat, and teeth will help to avoid this condition. The frequent use of potassium chlorate in a 2 to 4 per cent solution as a mouth wash and gargle is the treatment generally employed. The symptoms soon improve if no more mercury be given the patient.

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<sup>46</sup>Fisher's alkaline solution:  
Sodium carbonate, 10 gm.  
Sodium chloride, 12 gm.  
Distilled water to 1000 c.c.

### Bismuth

Only insoluble salts of bismuth are used to any extent in medicine.

#### Preparations and Doses.—

Bismuth subnitrate, dose, 8 gr.

Bismuth subcarbonate, dose, 8 gr.

Milk of bismuth, dose, 1 dr.

The subnitrate and subcarbonate are tasteless and insoluble. They may be given in powders, capsules or in suspension in water like the milk of bismuth.

**Action and Uses.**—All are mildly astringent, slightly antiseptic, and form a protective covering for irritated surfaces. The subnitrate, in large doses (30 to 40 grains), is often given in gastric catarrh and ulcer of the stomach. It is also often used in diarrhea and irritations of the bowels. It colors the stools dark or black.

Bismuth has been used extensively in x-ray examinations of the stomach and bowels as it is not transparent to the x-rays. A large quantity, several ounces, is swallowed for this purpose, usually suspended in milk, buttermilk, or some similar fluid. The *sulphate of barium* has largely taken the place of bismuth for this purpose.

## CHAPTER XIX

### THE HEAVY METALS

#### Iron

Iron is necessary to the life of all higher animals and plants. The red blood cells contain quite a lot of iron, and small amounts are found in most tissues of the body. Many articles of food, such as meat and eggs; and vegetables like spinach and beets, contain a considerable amount of iron.

#### Preparations and Doses.—

Tincture of iron (tincture of iron chloride), dose, 8  $\text{m}$ .

Reduced iron (finely powdered iron), dose, 3 gr.

Blaud's pills (pills of iron carbonate), dose, 2 pills.

Syrup of the iodide of iron, dose, 15  $\text{m}$ .

Citrate of iron and quinine, dose, 5 gr.

Citrate of iron and ammonia, dose, 5 gr.

Elixir, I. Q. and S. (iron, quinine, and strychnine phosphate), dose, 1 dr.

The tincture is mostly used externally. If given by mouth, it should be well diluted and sucked through a glass tube, as it is strongly acid and may injure or discolor the teeth. Reduced iron is tasteless and insoluble. It is mixed with sugar or jam and given to children who need iron. The citrates are nonirritating and soluble in water, and are usually given in solution. Iron should always be given after meals.

**Action and Uses.**—All the inorganic<sup>47</sup> salts of iron are astringent and irritant. The carbonate and citrates are not astringent and are best suited for internal use as they do not cause constipation or irritation of the stomach and bowels.

The tincture is used locally as a styptic<sup>48</sup> in bleeding that can be reached. A pledget of cotton soaked in the tincture should be pressed firmly upon the bleeding surface. It is useless if a vessel of considerable size has been cut. A very dilute solution is sometimes used as an astringent gargle.

Iron is given internally as a remedy in anemia. It is not considered of value in all forms of anemia, and has given best results in a condition called chlorosis,<sup>49</sup> seen often in young girls. It is also of value in simple anemia at any age, and in anemia following severe hemorrhage or a long spell of sickness. Long continued use of iron is necessary to obtain much benefit. The stools are usually dark or black when any form of iron is being taken.

The sulphate of iron being very cheap, is sometimes used to disinfect sewage or large masses of decomposing matter.

The freshly prepared hydrate of iron is much used as an antidote for arsenic. It is made by adding magnesia or soda to the sulphate or chloride of iron in solution.

Tannic acid and iron make ink and should not be mixed together. Oxalic acid will remove iron stains.

## Lead

This metal is not much used in medicine, and when used it is chiefly as an external application.

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<sup>47</sup>*Inorganic*, of mineral source, or not derived from anything organized.

<sup>48</sup>*Styptic*, a remedy that checks bleeding by causing an artificial clot to form.

<sup>49</sup>*Chlorosis*, (green sickness) a form of anemia seen mostly in young girls before puberty.



**Preparations and Doses.—**

Sugar of lead (lead acetate), dose, 1 gr.

Lead water (Goulard's lotion), externally.

The acetate is soluble in water, has a sweetish astringent taste but is seldom now given internally.

**Action and Uses.**—The only important action of lead is as an astringent. It has been used as a lotion in burns and various other skin lesions.

**Lead Poisoning (Chronic).**—This is the most common form of metal poisoning. It usually comes from handling or working among lead compounds as a daily task. Painters, plumbers, lead smelters, white lead workers and typesetters are the people most likely to have this form of poisoning. The symptoms develop slowly and rather irregularly. Constipation and lack of appetite, with a metallic taste and bad smelling breath, are usually observed. A blue line on the gums is often seen, and frequently there is more or less anemia and weariness. The more striking symptoms often come on quite suddenly. Only two will be described.

*Lead Colic (Painter's Colic).*—There is sudden and severe pain in the abdomen, not constant, but coming and going. The patient usually bends forward and presses the region of the umbilicus with both hands which seems to give some relief. During the attack, the pulse is slow and very hard. Between attacks the abdomen is tender.

*Treatment.*—Give morphine and atropine to relieve the pain and relax the intestine. Give Epsom salts in full doses to empty the bowel and perhaps remove some lead.

*Painter's Palsy (Wrist Drop, Lead Paralysis).*—This form of local paralysis is due to neuritis<sup>50</sup> caused by

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<sup>50</sup>*Neuritis*, inflammation of a nerve.

the lead. It usually affects only the forearm muscles which extend the wrist and fingers. Usually both hands and arms are alike, but sometimes only one is affected.

The treatment of this form of paralysis, and of lead poisoning in general need not be discussed here. Of course, in all such cases the victim should be advised to change his occupation.

### Copper and Zinc

These metals are now seldom used internally. Some insoluble zinc salts are quite often used externally upon the skin.

#### Preparations and Doses.—

Copper sulphate (blue vitriol), emetic dose,  
4 gr.

Zinc sulphate, emetic dose, 15 gr.

Zinc oxide, used externally only.

Ointment of zinc oxide.

Copper and zinc sulphates have a harsh metallic taste and are freely soluble in water. The copper sulphate is blue; the zinc sulphate is white. Zinc oxide is insoluble.

**Action and Uses.**—The sulphate of copper in about a 1 per cent solution is a fairly prompt emetic. The sulphate of zinc is an emetic also, but has been used less than the copper salt. Both have been used in croup and other conditions where an emetic is needed. Copper sulphate is recommended for use as an antidote in phosphorus poisoning.

Dry zinc oxide is used as a dusting powder. *Zinc stearate* is perhaps better for that purpose. The ointment is quite extensively used as an astringent and protective application in many forms of skin irritation and inflammation. An impure carbonate of zinc called *calamine* is also used on the skin for the same purpose.

### Silver Nitrate

The antiseptic uses of silver compounds have been discussed in another chapter. Silver is rarely given internally at the present time, but in the past it was used quite extensively in the treatment of some nervous diseases.

**Chronic Silver Poisoning.**—Silver in any form is absorbed slowly from the intestines and does not seem to be excreted at all. If taken a long time, a silver pigment is deposited in the deep layers of the skin and mucous membranes, giving the skin all over the body a dark color. This condition is called *argyria*. It is permanent and can not be removed.

### Alum

Alum is a double salt, potassium and aluminum sulphate. Its chief use is as an astringent, though large doses (1 to 2 drams) are emetic and may be used for that purpose. It is used as a gargle or wash in sore throat and inflamed conditions of other mucous membranes. Alum is a styptic and may be used to arrest hemorrhage from the nose or mouth. Dried alum (burnt alum) is somewhat caustic and is sometimes employed to destroy excessive granulations or small surface growths.

## CHAPTER XX

### THE ALKALIES

There are many alkaline substances that might come under this head, but in practical medicine the chief alkalies are the hydrates and carbonates of potassium and sodium with several compounds of magnesia.

#### **Preparations and Doses.—**

Caustic potash (potassium hydrate).

Caustic soda (sodium hydrate).

Potassium carbonate, dose, 15 gr.

Sodium carbonate, dose, 15 gr.

Potassium bicarbonate, dose, 30 gr.

Sodium bicarbonate (baking soda), dose,  
30 gr.

Magnesia (magnesium oxide), dose, 30 gr.

Magnesium carbonate, dose, 30 gr.

The potassium and sodium salts are all freely soluble in water. The magnesias are not. The two caustics are mostly used externally. The bicarbonate of soda is the one most frequently used for internal administration. Whichever one is used it should always be well diluted with water. The magnesias are given dry in powders, or suspended in water as *milk of magnesia*.

**Action and Uses.**—The caustic alkalies are sometimes used to remove small growths on the skin such as warts. The carbonates and bicarbonates are used to lessen acidity in the mouth, stomach, and intestines. After absorption they increase the alkalinity of the blood and all body fluids for a short time, but any excess above the normal alkalinity of health is quickly ex-

creted in the urine. This reduces the acidity of the urine, or may even make it alkaline.

The magnesias are antacid in the stomach, and are mildly laxative. The milk of magnesia is sometimes used as an aperient for children.

**Poisoning.**—Strong solutions of the caustic alkalies and of some of the carbonates are caustic and may cause serious injury. Lye, dehorning fluid and various cleaning compounds used in the home are strongly alkaline and caustic. Externally they may cause serious injury, but the chief danger is when they are swallowed and burn the walls of the esophagus and stomach. Children are often the victims of such accidents when they drink some of these alkali solutions by mistake. There is an alkaline, soapy taste followed at once by severe burning pain in the mouth, throat, and stomach. Vomiting soon follows and blood and shreds of mucous membrane may appear in the vomited matter. If some were drawn into the larynx, swelling of the glottis may cause death by asphyxiation. In severe cases collapse comes on with pale, anxious face, cold, clammy sweat, feeble pulse and respiration. Death may result from shock, or, if the patient survives, death may result months later from starvation, due to narrowing of the esophagus as a result of the caustic action of the alkali.

**Treatment.**—Neutralize at once with some acid that is not itself caustic. Vinegar, lemon juice, grape fruit juice or a solution of citric or tartaric acid should be given freely. Whatever mild acid can be had most quickly is the best, as time is important in limiting the amount of damage done. Give milk, eggs, or oil to protect the mucous membranes. Do not try to pass a stomach tube as it may penetrate the weakened wall of the esophagus or stomach.

Morphine will be needed to relieve the severe pain. The collapse is treated as usual with stimulants, caffeine or strychnine, and the application of external heat.

**Potassium acetate** and **sodium citrate** are sometimes used to make the urine less acid. They are also diuretic. Both are very soluble in water, and are given in about the same dose as bicarbonates, 30 gr.

### **Ammonia**

Ammonia is a strongly alkaline gas, very soluble in water and in alcohol.

#### **Preparations and Doses.—**

Ammonia water.

Aromatic spirits of ammonia, dose, 30 m.

Ammonia liniment.

The aromatic spirits are given by mouth, or the gas from it is inhaled. The others are used externally.

**Action and Uses.**—Ammonia is very irritating and penetrates the tissue quicker than the fixed alkalies, but its action does not last so long. It is sometimes inhaled or taken by mouth as a rapid reflex stimulant for the respiration and circulation. Externally it is used as a skin irritant. It will blister if the vapor is not allowed to escape.

**Poisoning** with ammonia is most frequently the result of a leak or break in the pipes of an artificial ice or cooling apparatus. Its use in the home as a cleaning agent may lead to accidental poisoning.

The stronger solutions are caustic and very irritating, and inhaling of the gas may cause death from swelling of the glottis. If swallowed, it causes intense pain, nausea, and vomiting similar to the other alkalies.

**Treatment.**—Give dilute vegetable acids, and treat generally as in poisoning with the fixed alkalies.



### **Lime, Chalk (Calcium)**

Salts of lime make up most of the hard tissues of the body, such as the bones and teeth; and their presence, in small amounts, is necessary for many functions of life.

#### **Preparations and Doses.—**

Calcium chloride, dose, 8 gr.

Limewater (aqua calcis), dose,  $\frac{1}{2}$  oz.

Carron oil (lime liniment).

Compound chalk powder, dose, 30 gr.

Chalk mixture, dose,  $\frac{1}{2}$  oz.

Calcium chloride is quite soluble in water. Carron oil is made by mixing equal parts of limewater and linseed or olive oil. The chalk is insoluble in water, but is suspended in water by means of some gum as acacia.

**Action and Uses.**—Limewater is alkaline and mildly astringent. When added to milk the particles of curd formed are smaller and the milk is more digestible.

When bone development in the young is delayed, as in rickets, lime is often given to furnish the material needed for bone growth or repair.

Carron oil has been used extensively in the treatment of burns and scalds, but has now been largely replaced by more antiseptic and more efficient remedies.

Chalk is used as an antacid and astringent in excessive acidity of the stomach and in diarrhea. It is also a valuable antidote in poisoning with an acid.

## CHAPTER XXI

### THE ACIDS

The mineral acids, hydrochloric, sulphuric and nitric, are not much used as medicinal agents. Acetic acid and the fruit acids are commonly used in food and drinks, but are not important as remedies.

#### Preparations and Doses.—

Dilute hydrochloric acid, dose, 15 ℥.

Nitric acid

Sulphuric acid

} only external uses.

Aromatic sulphuric acid, dose, 15 ℥.

Dilute acetic acid (like vinegar), dose, 30 ℥.

Tartaric acid (from grapes), dose, 8 gr.

Citric acid (from lemons, etc.), dose, 8 gr.

All are freely soluble in water and should be well diluted when given by mouth.

**Action and Uses.**—The strong mineral acids, especially nitric and sulphuric, are caustic. Even in dilute solutions they are quite antiseptic. All of these acids are astringent and more or less irritant.

Dilute hydrochloric acid is given to aid gastric digestion, when the gastric juice does not furnish enough of it. The fruit acids and vinegar are useful in poisoning with alkalies, and are ingredients of many cooling and effervescing drinks.

**Poisoning.**—The mineral acids are caustic and destroy tissue much as the alkalies do, but the burn is harder and not so deep. They may cause extensive damage if spilled or thrown upon the skin. The burn from nitric acid is yellow, that from sulphuric soon turns black.

If swallowed, these strong acids corrode the mouth, throat, and stomach, causing intense pain, nausea, vomiting and sometimes fatal collapse. If recovery takes place, stricture<sup>51</sup> of the esophagus may develop later on.

**Treatment.**—Neutralize with an alkali that is not itself caustic. Give magnesia or the carbonate of magnesium if at hand. Soap, limewater or chalk may be used; even wood ashes will help if nothing better is at hand. Sodium bicarbonate is excellent, but may cause so much gas in the stomach as to rupture its walls. Demulcents should be given freely and stimulants if there are symptoms of shock. The pain should be relieved with morphine.

### Tannic Acid Astringents

Tannic acid is used in medicine as an astringent, and preparations of certain plants containing tannic acid are used for the same purpose. Most of those so used contain nothing else of medicinal value.

#### Preparations and Doses.—

Tannic acid, dose, 5 gr.

Glycerite of tannic acid.

Compound tincture of gambir, dose,  $\frac{1}{2}$  dr.

Tincture of kino, dose,  $\frac{1}{2}$  dr.

Tannic acid is found in the bark and roots of most shrubs and trees. It is obtained chiefly from small growths called nut galls found on the twigs and leaves of oak trees. It is a light, feathery, yellowish powder, with a harsh, astringent taste and is soluble in water, alcohol, or glycerine. Kino and gambir are the dried juices of plants and contain much tannic acid.

**Action and Uses.**—These drugs are astringent in action, that is, they harden, toughen and shrink the

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<sup>51</sup>Stricture, the contraction or narrowing of a body passage.

tissues with which they come in contact. Tannic acid may be applied to the skin to harden and toughen it when it is exposed to irritation. It also tends to check excessive secretion of mucous membranes. When applied to a bleeding surface, it acts as a styptic and will stop bleeding from small blood vessels. Preparations containing tannic acid are used internally to control some forms of diarrhea. A very important use of tannic acid is as an antidote in poisoning with alkaloids and other poisons. As tea leaves contain considerable tannic acid, they are in an emergency, perhaps, the most convenient source of this antidote.

### **Benzoic Acid and Benzoic Compounds**

Benzoic acid is found in quite a number of substances used in medicine, especially in those called balsams.

#### **Preparations and Doses.—**

Benzoic acid, dose,  $7\frac{1}{2}$  gr.

Sodium benzoate, dose, 15 gr.

Benzoin (a balsam).

Compound tincture of benzoin.

Balsam of Peru.

Balsam of tolu.

Syrup of tolu, dose, 1 dr.

Sodium benzoate is soluble in water but benzoic acid is not. The latter is usually given in capsules. Benzoin and balsam of Peru are chiefly used externally. The syrup of tolu is given by mouth.

**Action and Uses.**—Benzoic acid and the balsams containing it are antiseptic and expectorant. Benzoin and balsam of Peru are used sometimes in parasitic skin diseases. Benzoic acid is sometimes used as a urinary antiseptic and especially to make the urine more acid.

The syrup of tolu is the only one of the series used much in cough.

### Prussic Acid

Prussic or hydrocyanic acid is of little use in medicine, but is very poisonous. It is found in bitter almonds, peach, cherry and plum seeds and the bark and other parts of wild cherry. The oil of bitter almonds, sometimes used as wild cherry flavoring, may contain enough to cause death. Pure prussic acid is a volatile liquid and 1 or 2 drops may cause death, which comes very quickly. The effects are brief stimulation, then rapid depression of the nervous system, heart and respiration. Death may occur in less than one minute and is seldom delayed over an hour.

**Treatment.**—There is seldom time to do anything if a large amount has been swallowed. Stimulants and artificial respiration may be tried, and hydrogen peroxide may be given by mouth in an attempt to oxidize some of the poison.

## CHAPTER XXII

### CHLORIDES, IODIDES, AND THYROID GLAND

#### **Sodium Chloride (Common Salt)**

Salt is found in all the fluids of the body and is necessary to life. Ordinary human food usually supplies all the salt the body needs and its use in food is chiefly to improve the flavor. Salt is a good preservative and large amounts are used in the preservation of food, especially of meat.

Strong solutions of salt in warm water are emetic. In silver nitrate poisoning, salt is the best antidote as it causes vomiting and makes the silver insoluble at the same time. A fairly strong solution of salt is sometimes injected into the rectum to destroy pinworms in children.

When the body has lost much fluid, as in hemorrhage or severe diarrhea, a solution of salt about the same strength as blood is often used to replace it temporarily. The salt solution may be given by rectum, hypodermically, or intravenously, according to the urgent nature of the case. This use of salt solutions has been found valuable in a great many conditions and is now the most important use of salt in medicine.

The intravenous use of salt solutions is not without danger, as large amounts may damage the red blood cells by diluting the blood too much.

Sometimes other substances found in blood are added to these solutions. Three frequently used formulæ are given below:



## PHYSIOLOGIC SALT SOLUTION

|                 |              |
|-----------------|--------------|
| Sodium chloride | 9.00 grams   |
| Distilled water | 1000.00 c.c. |

## RINGER'S SOLUTION

|                    |              |
|--------------------|--------------|
| Sodium chloride    | 9.00 grams   |
| Potassium chloride | .42 "        |
| Calcium chloride   | .24 "        |
| Sodium bicarbonate | .20 "        |
| Distilled water    | 1000.00 c.c. |

## LOCKE'S SOLUTION

|                    |              |
|--------------------|--------------|
| Sodium chloride    | 9.20 grams   |
| Potassium chloride | .42 "        |
| Calcium chloride   | .24 "        |
| Sodium bicarbonate | .15 "        |
| Dextrose (a sugar) | 1.00 "       |
| Distilled water    | 1000.00 c.c. |

**Ammonium Chloride**

This salt dissolves quite readily in water and is given by mouth in doses of about 5 gr. Its chief use is as an expectorant to loosen the bronchial secretions in irritating coughs. Large doses are liable to prove emetic like sodium chloride. A troche of this salt with extract of licorice is often used for sore throat.

Ammonium carbonate is sometimes used for coughs in the same way as the chloride and in about the same doses.

**Iodides**

The iodides are probably the most frequently used of all inorganic salts.

**Preparations and Doses.—**

|                  |                |
|------------------|----------------|
| Potassium iodide | } Dose, 7½ gr. |
| Sodium iodide    |                |

These salts are both very soluble in water and are usually given well diluted by mouth. As the patient becomes accustomed to it, the dose is gradually increased much above that given here.

**Action and Uses.**—Iodides are called alteratives, which really means that we do not know how they act, although they produce results.

The chief use of iodides is in the treatment of syphilis. They do not kill the germ of this disease and are of no use in recent syphilis. It is in later stages when the central nervous system, the blood vessels, the bones, the skin or some other tissue becomes involved that iodides give good results. They should be given for a long time and as much as the patient can stand.

Iodides have been much used in rheumatism, neuralgia and many other conditions where there is a suspicion of syphilitic taint. They increase almost all secretions and have been used as expectorants in cough. The thyroid gland secretion which contains iodine is often increased by iodides. This may be a benefit to the patient if the secretion was insufficient, or an injury if it was excessive before taking the iodide.

**Poisoning** with iodides does not often occur, but long-continued use may cause unpleasant symptoms called "Iodism." The eyes are reddened and the flow of tears excessive, the throat is sore and there is profuse secretion of saliva and bronchial mucus. Usually there is some cough and a slight fever. Skin eruptions may occur as in bromism but they are not always present.

**Treatment.**—Stop giving iodides and all the symptoms will soon disappear.

### Thyroid Gland

The thyroid is a small gland formed in the neck on each side of the trachea a little below the larynx. It

furnishes the body with a secretion containing much iodine that is necessary to the proper development of both body and mind. A child born without a thyroid gland or with one that does not furnish enough secretion, does not develop normally. This condition is called cretinism, a form of imbecility. If the thyroid gland is destroyed in an adult, or removed by surgical means, a condition similar to cretinism results. This is called myxedema. If the child with cretinism or the adult with myxedema be given a sufficient amount of the thyroid gland of some animal, their condition will improve very much or become almost normal. To keep up this benefit, however, requires the continued use of the thyroid gland throughout life.

The dried thyroid gland of sheep is used mostly, and is sold in tablets or as a powder. The adult dose is about 4 gr.

Goiter is an enlargement of the thyroid gland. In simple goiter the size of the gland is increased, but its secretion is often insufficient. In such a case, giving thyroid will often reduce the size of the gland. There is another form of goiter in which the gland secretes too much, causing a series of nervous symptoms. This form of goiter is made worse by giving thyroid.

Persons taking thyroid often lose in weight, and it has been used in obesity to reduce flesh. Some anti-fat remedies on the market contain thyroid and their indiscriminate use may do harm.

## CHAPTER XXIII

### LOCAL REMEDIES

#### Simple Bitters

Some of these are used only because they have a bitter taste which stimulates the secretion of saliva and gastric juice and aids digestion. There are a great many drugs that have a bitter taste, but most of them have some other important action in addition to taste.

#### Preparations and Doses.—

Compound tincture of gentian, dose,  $\frac{1}{2}$  dr.

Tincture of quassia, dose,  $\frac{1}{2}$  dr.

Tincture of calumba, dose,  $\frac{1}{2}$  dr.

These are all very bitter and are given by mouth either alone or with some other remedy.

**Action and Uses.**—Bitter substances increase the secretions of the mouth and stomach and improve appetite and digestion. They should not be given in acute indigestion or in an irritable condition of the stomach.

**Tincture of nux vomica** and **tincture of cinchona** are also much used as bitters. They are discussed in other chapters.

**Tincture of capsicum** (red pepper or Cayenne pepper) is not a bitter but has often been used to stimulate the appetite and digestion, especially in chronic alcoholism. Capsicum is a skin irritant when applied externally and is sometimes used for that purpose.

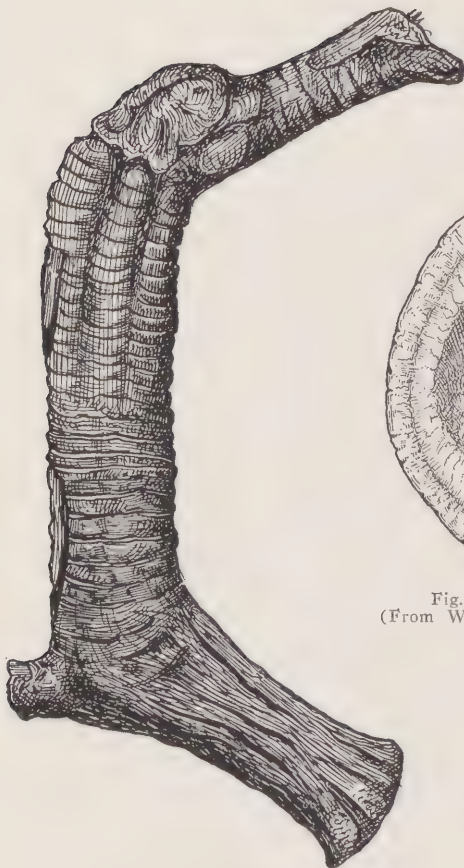


Fig. 41.—Gentian root. (From Wall's *Pharmacognosy*.)



Fig. 42.—Calumba root.  
(From Wall's *Pharmacognosy*.)

### Digestants

A few substances of both animal and plant source are able to digest food outside of the body and are sometimes given by mouth to aid digestion within the body.

#### Preparations and Doses.—

Pepsin, dose, 8 gr.

Pancreatin, dose, 8 gr.

Diastase and taka-diastase, dose, 3 gr.

Pepsin is obtained from the inner lining of the pig's stomach, and pancreatin usually from the pancreas of the same animal. Diastase is obtained from malt, which is a product of the brewing industry.

The value of these and similar substances in indigestion is not very great, but some conditions are improved by giving one of them when the normal digestive secretion seems to be insufficient or lacking.

### Volatile Oils

A volatile oil is present in every plant that has an odor. The oil is usually found in the flowers and fruits, but may be in any part of the plant. A large number of these volatile oils are used more or less in medicine, but only a few of them will be mentioned here as most of them are similar in many ways. Those most often used are, oil of peppermint, oil of spearmint, oil of cloves, oil of bitter almonds, oil of eucalyptus, oil of cinnamon (cassia), oil of anise and oil of lavender. These oils are very slightly soluble in water but are quite soluble in alcohol. Most of them have a hot, biting taste and the odor of the plant from which they come. The dose of any one of them is 1 to 2 minims and it should be well diluted.



Fig. 43.—Leaves and twigs of wintergreen. (From Wall's *Pharmacognosy*.)



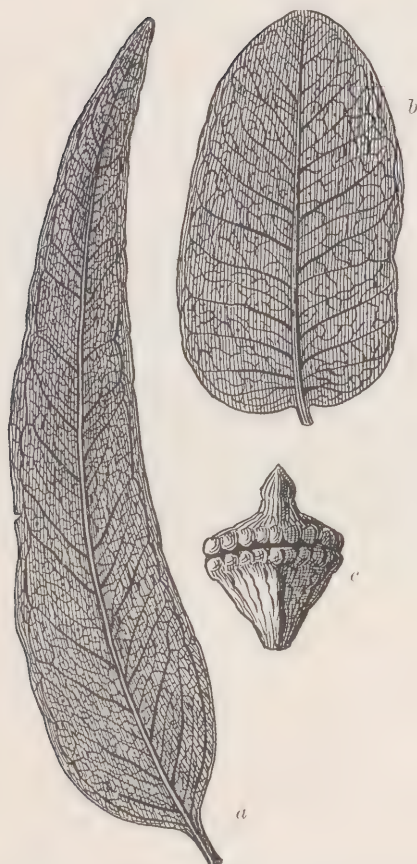


Fig. 44.—Eucalyptus leaves; (a) from older parts of tree; (b) from young branches, (c) unopened bud. (From Wall's *Pharmacognosy*.)

**Preparations (Alcoholic) and Doses.—**

|                          |   |             |
|--------------------------|---|-------------|
| Spirits of peppermint    | } | Dose, 20 m. |
| Spirits of spearmint     |   |             |
| Spirits of cinnamon      |   |             |
| Spirits of anise         |   |             |
| Spirits of lavender      |   |             |
| Spirits of bitter almond |   |             |

**Preparations in Water.—**

Peppermint water  
Cinnamon water  
Anise water  
Orange water



Fig. 45.—Ginger root, peeled. (From Wall's *Pharmacognosy*.)

No dose of the waters is stated as they contain only enough of the oil to give the odor and taste to it and they may be given freely.

**Action and Uses.**—Many of these oils are used to disguise a disagreeable taste or odor in medicine. Some are used in confectionery and in cooking.

All the volatile oils are more or less irritant and antiseptic. Some of them are applied to the skin in liniments. The oil of eucalyptus, and some others, are used as antiseptics. The oil of cloves is often used in a tooth cavity to relieve toothache. When taken by

mouth they have an effect on taste and secretion like that of bitters. In the stomach they are carminative, relieving flatulence, colic and gastric distress.

Most of the volatile oils tend to relax smooth muscle organs when brought in contact with them, but a few of them, oil of anise, and oil of turpentine in particular, cause the muscle of the intestine to contract when very small amounts are used.

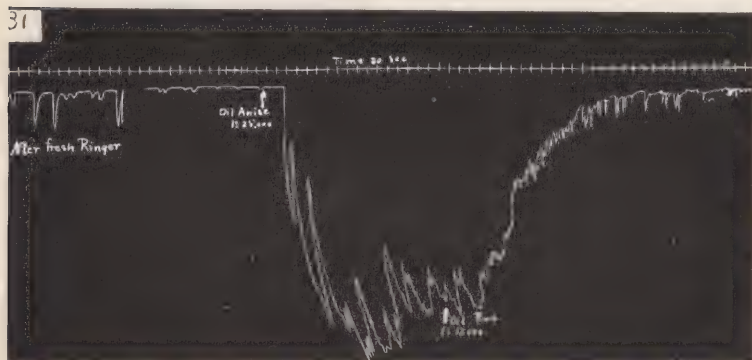


Fig. 46.—Tracing showing the action of the oil of anise on a segment of dog's intestine.

The oil of wintergreen belongs to this series but is discussed with the salicylates, and the oil of turpentine, another volatile oil, is discussed with skin irritants.

### Anthelmintics

By this term is meant the remedies used to destroy or expel worms that live in the intestinal canal. Those remedies that destroy worms are sometimes called *vermicides* while those that expel them alive are called *vermifuges*.

The intestinal worms most common in this country are tapeworm (*tænia*), roundworm, hookworm and pinworm.

**Tapeworm Remedies and Doses.—**

Oleoresin of male fern (*Aspidium*), dose, 30 m.

Pelletierine tannate (an alkaloid from the pomegranate root), dose, 4 gr.

The oleoresin of male fern is given in capsules or as an emulsion. It will not dissolve in water. Pelletierine can be given in capsules or in a syrupy mixture. These doses are given once and not repeated until it is determined that the head of the worm was not removed.



Fig. 47.—Root (rhizome) of *aspidium* (male fern). (From Wall's *Pharmacognosy*.)

**Roundworm Remedies and Doses.—**

Santonine, dose,  $\frac{1}{2}$  to 2 gr.

Troches of santonine,  $\frac{1}{2}$  gr. each.

Santonine is not soluble in water and has very little taste. It may be given in sugar, jelly, or jam. Children will eat the troches as candy. Even ordinary doses may cause things to look yellow for a short time and the remedy had best be given at bedtime. A brisk purge should be given the next morning. Overdoses of santonine may cause serious symptoms resembling strychnine poisoning, though less severe.

**Hookworm Remedies and Doses.—**

Thymol (from oil of thyme), dose 15 gr.

Oil of chenopodium (American wormseed),  
dose, 10 m.

These remedies are best put in capsules and should only be given once a day, but their daily administration should continue for some time. As a rule, a laxative should accompany or follow the dose.

**Pinworm Remedies.**—As these little pests are only in the rectum their treatment is purely local. Injections of quassia, alum, salt, tannic acid, limewater and mild antiseptics, such as borax, have been used.

**Demulcents**

Many slimy, adhesive substances are used as a soothing and protective covering for irritated mucous membranes. Nature usually secretes mucus for this purpose, but when that secretion is not present, or is very scanty, we may supply a suitable substitute for mucus. Many excellent demulcents are common household materials such as white of eggs, milk, boiled starch, ice cream, jellies and barley or oatmeal gruel. Those commonly kept in drug stores are as follows:

**Preparations and Doses.—**

Acacia (gum arabic)

Mucilage of acacia, dose,  $\frac{1}{2}$  oz.

Almond emulsion (milk of almonds).

Licorice root (glycyrrhiza).

Extract of licorice (licorice stick).

Compound licorice powder, dose, 1 dr.

Compound licorice mixture (brown mixture), dose, 1 to 2 dr.

The acacia is seldom used alone, and is employed, mostly, to hold some insoluble remedy in suspension in

water. Licorice contains a sweet principle as well as sticky material, and as its taste is pleasant, it is much used as a confection. The compound licorice powder contains senna, and is used as a mild laxative for children. The compound licorice mixture contains a little opium and is often used as a cough remedy.

**Action and Uses.**—The action of demulcents is purely mechanical. They soothe and protect irritated surfaces and retard absorption. One of their most important uses is in the treatment of poisoning with an irritant. A solution of corrosive sublimate made with milk (or other demulcent), will cause much less irritation of the mouth, throat, and stomach, if swallowed, than a solution of the same strength in water. In any case of poisoning with an irritant, the most quickly obtained demulcent is usually the best, as prompt treatment is very important. In poisoning with cantharis or phosphorus, however, milk, cream or any oily substance should not be given.

Demulcents are sometimes mixed with an enema to be absorbed, as the lessened irritation helps the patient retain the enema.

## CHAPTER XXIV

### LOCAL REMEDIES

#### Skin Irritants

The practice of applying some form of irritation to the skin in the treatment of diseases has been used since the earliest days of medicine. Rubbing with the hand and the application of heat or cold are forms of

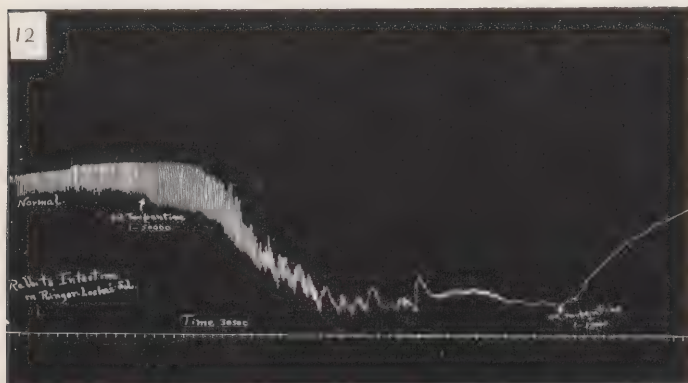


Fig. 48.—Tracing showing the action of oil of turpentine on a segment of rabbit's intestine.

skin irritation very frequently applied. Many of the volatile oils have been used as skin irritants, and alcohol, chloroform and other important remedies are often used for the same purpose. The skin irritants discussed below are those seldom used for any other purpose.

Certain words are used in medicine to describe the degree of irritation caused by a substance applied to



the skin. A **rubefacient** is an irritant that causes redness of the skin. A **vesicant** causes redness and produces blisters (vesicles). A **pustulant** causes small pustules to form in the skin.

### Mild Skin Irritants (Rubefacients)

Oil of turpentine, dose, 15 m.

Chloroform liniment.

Camphor liniment.

Spirits of camphor, dose, 15 m.

Tincture of iodine.

Menthol.

Although comparatively mild in action, most of these will blister the skin if applied very often, or if not allowed to evaporate from the skin.



Fig. 49.—Cantharis or Spanish fly, about natural size. (From Wall's *Pharmacognosy*.)

Camphor and the oil of turpentine are carminatives and are sometimes given in flatulence or colic. Menthol is applied locally to relieve neuralgia or some similar pain.

### Severe Skin Irritants (Vesicants)

Mustard (sinapis), white and black.

Mustard plaster (or paper).

Spanish fly (cantharis).

Fly blister (cantharis plaster).

Tincture of cantharis.

The severe forms of irritation of the skin resulting in blisters are seldom used at the present time as the milder effects, such as redness of the skin, seem to give as good results.

Mustard is a common household article and is used as a relish with certain foods. In preparing mustard, or mustard paper, for use, hot water must not be used as it destroys a ferment in the mustard and prevents the formation of the *volatile oil of mustard* which is the irritant. A teaspoonful of mustard stirred into a little warm water and swallowed will often serve as an emergency emetic.

The Spanish fly is a bright green beetle about the size of our common firefly. Its body contains a nonvolatile irritant which acts slower than mustard, but is more severe. It takes 8 to 10 hours to produce a blister in most cases.

Skin irritants in general are used to relieve pain and promote healing in injuries such as sprains where the skin is not broken. They are also applied to certain areas of the skin to relieve pain in adjoining deeper organs such as the lungs, stomach, and ovaries. The mental effect of skin irritation, whether in the form of rubbing, the application of heat or cold, or an irritant drug, often produces marked improvement in a patient's symptoms.

**Poisoning.**—Cantharis internally, unless in very small amounts, causes intense irritation of the mouth, throat, and stomach, producing nausea, vomiting, and severe burning pain. There may also be diarrhea. A little later on it causes irritation of the genitourinary passages with frequent, painful urination, often bloody urine, and finally complete suppression of the urine.

**Treatment.**—If the case is seen early, the stomach should be thoroughly washed out. In any case demulcents should be given freely, but not those containing fats such as milk and cream. Morphine may be necessary to relieve the pain and constant vomiting. Stimulants will be necessary should collapse develop.

### **Emollients**

Fatty and oily substances are applied to the skin for much the same purpose as demulcents are applied to mucous membranes. Fats and oils from both vegetable and animal sources and the bland oils from petroleum are employed as emollients.

#### **Preparations.—**

- Lard (adeps), the internal fat of pigs.
- Benzoinated lard (benzoin a preservative).
- Lanolin (sheep's wool fat).
- Paraffin oil (liquid petrolatum).
- Vaseline (petrolatum).
- Paraffin (hard paraffin).
- Olive oil (sweet oil), from ripe olives.
- Oil of almonds (the nonvolatile oil).
- Cotton seed oil.
- Glycerine.
- Cold cream (ointment of rose water).

This oil of almonds should be distinguished from a volatile oil obtained from bitter almonds which contains the poison, prussic acid. Glycerine is obtained from fats in the process of soap making. Lard, olive oil, and cotton seed oil are used as articles of food as well as remedies.

**Action and Uses.**—Some of these are used as soothing and softening applications in cases of chapped hands or face, small cuts, burns or scalds. Others are used chiefly

to mix medicinal substances for application to the skin as ointments or liniments. Medicines are more readily absorbed from the skin when mixed with fats than in solution in water.

Glycerine is slightly irritating, at first, to the skin or a raw surface, but this action does not last long. Its use as a laxative is discussed in another chapter.

Paraffin has recently been used quite extensively in the treatment of burns. It is used alone, or containing some antiseptic or other ingredient. It is melted and sprayed on the burned surface while in a liquid state, but immediately forms a solid, air-tight, sterile covering.

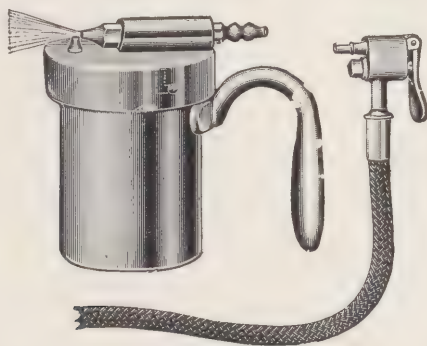


Fig. 50.—Caldwell's paraffin sprayer for applying paraffin to burns.

### Flavoring Substances

Sugar, milk sugar, syrup and honey are used to sweeten medicinal mixtures. They have no medicinal effect but are of value as foods.

Many of the volatile oil series are used to flavor medicines. They are used mostly in the form of medicated waters.

Some fruit acids are used to give an acid flavor to medicines. The *syrup of citric acid* is an example.

Wild cherry, licorice and cocoa are frequently used in syrups or elixirs as a means of disguising disagreeable remedies or improving the taste of medicinal mixtures.

**Saccharine** is a coal tar derivative used to sweeten food, drink, and medicine. When sugar may not be given for any reason, minute quantities of saccharine can be given instead. It is 500 times as sweet as cane sugar, but has no food or medicinal value.

### Mechanical Remedies

**Collodion** is a solution of soluble gun cotton (pyrox-  
ylin, celloidin) in ether and alcohol. When applied to the skin or a wound the ether and alcohol evaporate leaving a protective film of cotton. Medicinal substances, such as salicylic acid or cantharis, may be dissolved in collodion.

**Cocoa butter** is obtained from the cocoa bean or seed from which chocolate and cocoa are obtained. It is used chiefly for making suppositories which melt at body temperature.

**Keratin** is a substance obtained from hoofs and horns of animals. It is used to make capsules that will pass through the stomach undissolved, as it is soluble only in the alkaline secretions of the intestines. Capsules made of salol are sometimes used for the same purpose, as salol does not dissolve in the stomach.

**Plasters** are used mostly for mechanical support, but are sometimes medicated as belladonna and cantharis plasters. *Adhesive plaster*, *court plaster* and lead or *diachylon plaster* are frequently used.

## CHAPTER XXV

### EMERGENCY REMEDIES

Although, under ordinary circumstances, a nurse should not administer active remedies on her own responsibility, there are emergencies that may occur in which a life may be saved or much suffering prevented by the prompt administration of the proper remedy by a nurse. A brief summary of some remedies that may be used in circumstances of great danger or distress when the services of a physician can not be secured is given herewith.

**Abortion.**—Threatened, morphine hypodermically or opium by mouth.

**Angina pectoris.**—Amyl nitrite by inhalation, nitroglycerine hypodermically or sweet spirits of nitre by mouth.

**Asthma.**—To relieve, amyl nitrite or the fumes of burning saltpetre by inhalation, adrenalin solution hypodermically, atropine or hyoscyne hypodermically.

**Bites—Insect.**—Ammonia or baking soda applied locally. If very severe, a small drop of creosote (beechwood), guaiacol or lysol may be applied to the point of irritation.

**Bites—Snake.**—Potassium permanganate in strong solution or pure crystals applied to the wound.

**Bites—Rabid Dog.**—Tincture of iodine, potassium permanganate, or pure carbolic acid applied in and about the wound. If carbolic acid is used it should be soon washed off with alcohol.

**Burns and Scalds.**—If small, may be covered with collodion; of moderate extent, picric acid saturated solution in water or picric acid gauze applied to injured surface; if severe pain, powdered chloretone dusted over surface. To exclude air on burn of any extent, use Carron oil, cold cream, vaseline, sweet oil or other convenient emollient.

**Colic.**—In infant, spirits of peppermint or of anise, Hoffmann's drops or paregoric cautiously by mouth.

**Colic.**—Renal or gall bladder, morphine, atropine or both together hypodermically, chloroform or ether by inhalation when pain is very severe.

**Colic.**—Lead, atropine or atropine and morphine hypodermically, Epsom salts by mouth.

**Collapse.**—Sudden, ammonia vapor by inhalation, strychnine, caffeine or camphor in solution in oil hypodermically, adrenalin solution intravenously.

**Convulsions.**—In children, bromides or chloral hydrate or both by mouth or by rectum. If unconscious or can not swallow, amyl nitrite by inhalation.

**Convulsions.**—From strychnine, chloroform or ether by inhalation, chloral hydrate by rectum.

**Convulsions.**—Of childbirth, morphine hypodermically, chloroform or ether by inhalation.

**Croup.**—Heat menthol crystals in sleeping room so child may breathe the fumes, amyl nitrite by inhalation, an emetic such as syrup of ipecac or syrup of squills by mouth.

**Emetics** when needed, salt, mustard, alum, or fluid extract of ipecac by mouth, apomorphine hypodermically.

**Hemorrhage.**—Internal, morphine hypodermically to quiet patient and favor clotting.

**Hemorrhage.**—From lungs, amyl nitrite by inhalation.



**Hemorrhage.**—From uterus, ergot by mouth or hypodermically, pituitrin hypodermically, hydrastinine hypodermically.

**Hemorrhage.**—External, when no large vessel is bleeding, adrenalin solution, tannic acid, alum or chloride of iron in solution applied locally.

**Hiccough.**—Persistent, Hoffmann's drops by mouth, amyl nitrite by inhalation or nitroglycerine by mouth or hypodermically.

**Insanity.**—Violent, hyoscine hypodermically or apomorphine hypodermically but in doses too small to cause vomiting, paraldehyde or chloral hydrate by mouth.

**Toothache.**—Chloretone dissolved in oil of cloves, oil of cloves alone, oil of peppermint or creosote put in tooth cavity on cotton.

**Vomiting.**—Chloretone dissolved in hot water by mouth, bismuth subnitrate, limewater when sour stomach, carbonated water or a drop of carbolic acid well diluted.

**Vomiting.**—Of pregnancy, seasickness, etc., veronal or bromide of soda by mouth; if very severe, morphine hypodermically.



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